Course guide
340608 - SETR-R2O07 - Embedded and Real Time Systems

Last modified: 04/07/2023

Unit in charge: Vilanova i la Geltrú School of Engineering
Teaching unit: 707 - ESAII - Department of Automatic Control.
710 - EEL - Department of Electronic Engineering.

Degree: MASTER'S DEGREE IN AUTOMATIC SYSTEMS AND INDUSTRIAL ELECTRONICS (Syllabus 2012). (Optional subject).

Academic year: 2023 **ECTS Credits:** 5.0 **Languages:** Spanish

LECTURER

Coordinating lecturer: Ramon Guzmán Solà

Others: Ramon Guzmán Solà
Rafael Ramos Lara
Mariano López García

TEACHING METHODOLOGY

LEARNING OBJECTIVES OF THE SUBJECT

STUDY LOAD

Type	Hours	Percentage
Hours small group	30,0	24.00
Hours large group	15,0	12.00
Self study	80,0	64.00

Total learning time: 125 h

CONTENTS

Theory

Description:
The course is divided into two parts. On the one hand, the student will gain the basic knowledge of embedded systems, both from the point of view of architecture and from the point of view of programming. On the other hand, the student will understand the particular problems of real-time systems, and the features that differentiate them from other computer systems. They will learn the most important methods used to develop highly reliable real-time systems, especially those related to time measurement, resource use planning, prevention and tolerance. failures, and the organization of the software and its application. Special consideration will be given to process control applications. Various techniques will be proposed to develop these applications and the mechanisms needed to evaluate their performance will be established.

The subject is divided into two parts.

A) Embedded systems

UNIT 1: Introduction to embedded systems and Atmel AVRs.
1.1 Introduction to embedded systems.
1.2 Introduction to Atmel AVRs.
1.3 Characteristics of the ATmega328P µC.

SUBJECT 2: Internal architecture of the ATmega328P µC.
2.1 Internal architecture of the ATmega328P µC.
2.2 Memory spaces

SUBJECT 3: I / O ports, Analog Comparator, Analog-Digital Converter and Interruptions.
3.1 I / O ports
3.2 Analog comparator.
3.3 Analog-Digital Converter.
3.4 Interruptions.
3.5 External interruptions.

SUBJECT 4: Timers and communication ports: USART, TWI (I2C) and SCI.
4.1 Timers.
4.2 USART.
4.3 TWI (I2C) - Two Wire serial Interface.
4.4 SPI - Serial Peripheral Interface

Practices:

Q1: Introduction to the ARDUINO platform.
Q2: Temperature measurement with AD22103 sensor and On-Chip sensor.
Q3: Geomagnetic guidance system with ARDUINO.
Q4: PID control of a DC motor.

B) Real time

SUBJECT 1: Introduction to the systems of real time
SUBJECT 2: Cyclic systems.
SUBJECT 3: Task scheluders
SUBJECT 4: Sharing of recusros

Practices:

Q1: Initialization to trueTime in Matlab environment
Q2: Design of a control system using the trueTime tool

Full-or-part-time: 220h

Theory classes: 125h
Practical classes: 15h
Self study : 80h

GRADING SYSTEM

The final mark is obtained from the marks of both parts, Embedded systems and real time.

The mark of embedded systems is obtaines as : NF1=0,6NT1+0,4NP1
where
Nota sistemes encastats: NF1= 0,6NT1+0,4NP1
on
NT1 is the mark obtained from the theory of embedded systems
NP1 is the mark obtained in the laboratory form the different practices : NP1= (P1+P2+TASIG)/3

The mark of real time is obtaines as: NF2= 0,6NT2+0,4NP2
where
NT2 is the mark obtained from the theory of real time : NT2=max0.5(C1+C2) and C1 is the mark of the first exam and C2 is the mark of the secon exam
NP2 is the mark obtained in the laboratory form the different practices.
The mark of the subject is calculated as: NF=0.5NF1+0.5NF2