



Course guide

340122 - ININ-K6007 - Industrial Informatics

Last modified: 17/05/2023

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

Degree: BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Optional subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: Francesc Xavier Parra Llanas

Others: Francesc Xavier Parra Llanas

TEACHING METHODOLOGY

LEARNING OBJECTIVES OF THE SUBJECT

To introduce the student in the world of industrial computer systems, and the characteristics that differentiate them from other computer systems. The Student will learn the most important methods used to transfer information in industrial computer systems, especially the aspects related to the synchronization of actions, the architecture of industrial computers and the organization of software and its application. Process control applications will be considered in a special way and the methodology for designing and developing these applications will be shown. Some tools (programming languages and operating systems) suitable for the realization of industrial computer systems will be used and the theoretical concepts necessary to approach the realization of computer systems with a deterministic temporal behaviour will be studied.

STUDY LOAD

Type	Hours	Percentage
Self study	90,0	60.00
Hours small group	30,0	20.00
Hours large group	30,0	20.00

Total learning time: 150 h



CONTENTS

Theory

Description:

Contents

1. INTRODUCTION

Introduce the student to the world of computer applications in the field of industry, by identifying the characteristics that are typical of control systems, as well as the different elements that make up an industrial computer system.

1.1. The computer in control systems.

1.2. Historical evolution of control systems.

1.3. Structure of a control system.

1.4. Characteristics and needs of control systems.

1.5. Example of control system.

2. THE PHYSICAL PROCESS

Identify the different types of physical process and the different ways to describe it. The stages to carry out the analogical and digital control of a continuous process will be presented, as well as the different types of control typical of the field of industrial computing.

2.1. Classification and description of processes.

2.2. Analog control of continuous processes.

2.3. Digital control of continuous processes.

2.4. Discrete processes.

3. INDUSTRIAL COMPUTER ARCHITECTURE

Describe the possible architectures and configurations of an industrial computer. Characterize the interfaces with the process for data transfer through the peripherals of the industrial computer. The data transfer techniques for the synchronization of the actions to be executed in an industrial computer will be specially described.

3.1. Introduction.

3.2. Computer structure.

3.3. Data transfer techniques.

3.4. Interfaces with the process.

3.5. Communication interfaces.

3.6. Bus-based systems.

4. INDUSTRIAL COMPUTER PROGRAMMING

Learn to differentiate and describe the different types of control application programming. Aspects related to operating systems and programming languages for control applications with temporary requirements will be addressed.

4.1. Types of programming.

4.2. Operating systems.

4.3. Programming languages.

5. THE PC: AN EXAMPLE OF INDUSTRIAL COMPUTER

Know the specific architecture of the PC as an industrial computer. Aspects related to the internal registers of the processor, the memory structure and the input and output access with the peripherals will be addressed.

5.1. PC architecture.

5.2. PC memory.

5.3. PC peripherals.

Full-or-part-time: 30h

Theory classes: 30h



Laboratory

Description:

Objectives

The main objective is to learn to program solutions to problems in the field of industrial computing. We will work on an open electronics platform for prototyping based on flexible and easy-to-use software and hardware: Arduino UNO R3. We will learn to manage its digital inputs and outputs, to program external interrupts and timers, and to use analog peripherals. Finally, we will program on the development platform several applications as a implementation of a general solution previous designed (the specific problems to be implemented will be chosen specifically for each course).

Contents

1. Introduction to the Arduino work environment.
2. I/O ports.
3. External interrupts.
4. Timers.
5. Analog Comparator and Analog-to-Digital Converter.
6. Problem 1: the lighting system.
7. Problem 2: the gait characterizer.
8. Problem 3: the toaster.

Full-or-part-time: 30h

Theory classes: 30h

GRADING SYSTEM

Grade takes into account all the work done along the course. The final mark is obtained by applying the following formula:

$$NF = \text{MAX}(0,2 \cdot EP + 0,3 \cdot EF, 0,5 \cdot EF) + 0,4 \cdot \sqrt{(PL \cdot EL)} + 0,1 \cdot MP$$

where: EP = mark of the partial examination, EF = mark of the final examination, PL = mark of the laboratory practices, EL = mark of the laboratory examinations, MP = mark of the miniproject and NF = final mark of the subject.

BIBLIOGRAPHY

Basic:

- Thomas, David; Hunt, Andrew; Yitbarek, Saron. *The Pragmatic programmer : your journey to mastery*. 20th ed. Boston: Addison-Wesley, 2020. ISBN 9780135957059.
- White, Elecia. *Making embedded systems* [on line]. Sebastopol: O'Reilly, 2011 [Consultation: 13/03/2023]. Available on: https://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,uid&db=nlebk&AN=415026&site=ehost-live&ebv=EB&ppid=pp_C_over. ISBN 1-4493-2058-9.
- Hughes, J. M. *Arduino : a technical reference : a handbook of technicians, engineers, and makers* [on line]. Sebastopol: O'Reilly, 2016 [Consultation: 13/02/2024]. Available on: <https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=4543968>. ISBN 9781491921760.