INSTITUTO POLITÉCNICO DE BRAGANÇA

Course Unit	Embedded Systems			Field of study	Computer Engineering		
Bachelor in	Informatics Engineering			School	School of Technology and Management		
Academic Year	2023/2024	Year of study	1	Level	1-1	ECTS credits	6.0
Type	Semestral	Semester	2	Code	9119-706-1205-00-23		

Workload (hours)	162	Contact hours	T -	TP 60	PL -	TC -	S -	E -	OT -	O -

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s)	Joao Afonso Braun Neto, José Augusto de Almeida Pinheiro Carvalho, Flavia Georgina da Silva Pires, Gustavo Silva Funchal, Rebeca Baron Kalbermatter

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:
1. Analyse simple microcontroller architectures based on block diagrams and practical implementation schematics.
2. Design microcontroller based systems.
3. Program systems based on microcontrollers using C programming language.
4. Develop microcontroller based applications with both components: software and with its supporting hardware.
5. To know how to use communication protocols between microcontrollers and peripherals.

Prerequisites

Before the course unit the learner is expected to be able to:
Develop basic projects based on Digital systems.

Course contents

Basic architecture of embedded systems; Low and high level languages programming; Microprocessors and microcontrollers; IO system and communication protocols.

Course contents (extended version)

1. Architecture of an embedded system
   - Typical 8-bit microcontroller
   - Registers, memories, instructions
2. Programming of a Microcontroller-based System
   - Real time concepts
   - Microprocessors and microcontrollers
   - Arduino
   - Data acquisition of sensors and actuators for process control
3. Interruptions (internal and external) of a microcontroller
4. Communication protocols
   - UART, SPI, I2C, 1-wire, Bluetooth, RFID e Ethernet

Recommended reading

1. John P. Hayes, Digital System Design and Microprocessors, McGraw-Hill. Fredrick J. Hill, Gerard R. Peterson, Digital Logic and Microprocessors, John Wiley and Sons. 1984.
2. Simon Monk, Programming Arduino: Getting Started with Sketches, Second Edition, McGrow Hill. 2016.
3. Elecia White, Making Embedded Systems: Design Patterns for Great Software, O'Reilly. 2011.

Teaching and learning methods

The unit will be taught using a combination of theoretical lectures and self-learning practical classes guided by the teacher. The practical classes will be oriented to practical case studies, to be solved through projects.

Assessment methods

1. Mandatory attendance regime. - (Regular) (Final, Supplementary, Special)
   - Final Written Exam - 40% (Final written test without consultation.)
   - Practical Work - 60% (4 worksheets (10%) + 2 pratical works 20% and 30% and minitests.)
2. Optional attendance regime. - (Student Worker) (Final, Supplementary, Special)
   - Final Written Exam - 40% (Final written test without consultation.)
   - Practical Work - 60% (4 worksheets (10%) + 2 pratical works 20% and 30% and minitests.)

Language of instruction

English, with additional Portuguese support

Electronic validation

Joao Afonso Braun Neto, José Augusto de Almeida Pinheiro Carvalho	José Luís Sousa de Magalhaes Lima	Luís Manuel Alves	José Carlos Rufino Amaro
16-03-2024	16-03-2024	16-03-2024	24-03-2024