Course Unit	Embedded Systems			Field of study	Computer Engineering		
Bachelor in	Informatics Engineering			School	School of Technology and Management		
Academic Year	2022/2023	Year of study	1	Level	1-1	ECTS credits	6.0
Type	Semestral	Semester	2	Code	9119-706-1205-00-22		

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)	José Augusto de Almeida Pinheiro Carvalho, José Luís Sousa de Magalhaes Lima, Joao Afonso Braun Neto, Thadeu Vinicios de Brito

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. Programming microcontroller based systems 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.
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. Alternative 1 - (Regular) (Final, Supplementary, Special)
   - Final Written Exam - 40% (Final written test.)
   - Practical Work - 60% (2 practical works (30% + 30% with a mini test))
2. Alternative 2 - (Student Worker) (Final, Supplementary, Special)
   - Final Written Exam - 40% (Final written test.)
   - Practical Work - 60% (2 practical works (30% + 30% with a mini test))

Language of instruction

Portuguese, with additional English support for foreign students.

Electronic validation

José Augusto de Almeida Pinheiro Carvalho, José Luís Sousa de Magalhaes Lima	Luísa Maria Garcia Jorge	José Carlos Rufino Amaro
21-03-2023	22-03-2023	25-03-2023