

Course Unit	Embedded Systems		Field of study	Computer Engineering	
Bachelor in	Informatics Engineering		School	School of Technology and Management	
Academic Year	2021/2022	Year of study	1	Level	1-1
Type	Semestral	Semester	2	ECTS credits	6.0
			Code	9119-706-1205-00-21	
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, 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, McGraw 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

Electronic validation

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02-03-2022	06-03-2022	20-03-2022