

Course Unit	Embedded Systems		Field of study	Computer Engineering	
Bachelor in	Informatics Engineering		School	School of Technology and Management	
Academic Year	2024/2025	Year of study	1	Level	1-1
Type	Semestral	Semester	2	ECTS credits	6.0
Code	9119-706-1205-00-24				
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 Luís Sousa de Magalhaes Lima, Flavia Georgina da Silva Pires, João 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. 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, 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. Mandatory attendance regime. - (Regular) (Final, Supplementary, Special)
  - Final Written Exam - 40% (Final written test without consultation.)
  - Practical Work - 60% (4 worksheets (10%) + 2 practical 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 practical works 20% and 30% and minitests.)

### Language of instruction

English, with additional Portuguese support

### Electronic validation

José Luís Sousa de Magalhaes Lima	José Augusto de Almeida Pinheiro Carvalho	Luís Manuel Alves	José Carlos Rufino Amaro
22-02-2025	23-02-2025	25-02-2025	30-03-2025