



Universitat de Lleida

DEGREE CURRICULUM  
**EMBEDDED AND UBIQUITOUS  
SYSTEMS**

Coordination: GUIRADO FERNANDEZ, FERNANDO

Academic year 2023-24

## Subject's general information

<b>Subject name</b>	EMBEDDED AND UBIQUITOUS SYSTEMS			
<b>Code</b>	103056			
<b>Semester</b>	1st Q(SEMESTER) CONTINUED EVALUATION			
<b>Typology</b>	Degree	Course	Character	Modality
	Master's Degree in Informatics Engineering	1	COMPULSORY	Attendance-based
<b>Course number of credits (ECTS)</b>	4.5			
<b>Type of activity, credits, and groups</b>	<b>Activity type</b>	PRALAB	TEORIA	
	<b>Number of credits</b>	3	1.5	
	<b>Number of groups</b>	1	1	
<b>Coordination</b>	GUIRADO FERNANDEZ, FERNANDO			
<b>Department</b>	COMPUTER ENGINEERING AND DIGITAL DESIGN			
<b>Teaching load distribution between lectures and independent student work</b>	30% lecture 70% autonomous work			
<b>Important information on data processing</b>	Consult <a href="#">this link</a> for more information.			
<b>Language</b>	English			
<b>Distribution of credits</b>	10% theory 30% classroom activities 60% laboratory			

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
GUIRADO FERNANDEZ, FERNANDO	fernando.guirado@udl.cat	4,5	
GUIRADO FERNANDEZ, FERNANDO	fernando.guirado@udl.cat	0	

## Subject's extra information

We recommend programming skills in C and C++

Mostly practical subject in which the study is based on the resolution of a project based on the SCRUM methodology.

Group work and personal predisposition are essential to obtain the established competencies and acquire the necessary skills to solve the project.

Didactic materials can be found on the Virtual Campus: <http://cv.udl.cat>

The use of the Virtual Campus is essential to access the resources of the subject and the notifications and delivery dates of the Sprints.

Subject that is taught during the 2nd semester of the 1st year of the degree.

Corresponding to the "Informatics" Subject within the "Information Technologies" Module

## Learning objectives

### University of Lleida strategic competences

- To use office automation tools for the development of technical documents
- Create presentations using office automation tools
- Understand technical documents in English

### Degree-specific competences

- Ability to evaluate the hardware and software requirements for the development of embedded and ubiquitous systems
- Understand the concept of embedded system and ubiquitous
- Know how to design, describe i validate embedded electronic systems with industrial application
- Know and be able to use methods and tools for development and debugging of programs implemented with microcontrollers
- Understand and know the different technological options for developing embedded systems
- Identify control requirements, interaction and security you have to give in an embedded system
- Identify requirements of E / S necessary to develop an embedded system

### Degree-transversal competences

- Independent learning ability and adaptación to new situations, able to foster creativity and sensitivity for quality
- Analytical skills, organization or planning in the area of computer and embedded systems

## Competences

### General Competences

CG1. Capacity to project, calculate and design products, processes and installations in all fields of Computer Engineering.

CG8. Capacity to apply the knowledge acquired for solving problems in new and unfamiliar situations within broader and more multidisciplinary contexts, and to be capable of integrating this knowledge.

### Basic Competences

CB2. That the students can apply their knowledge and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study.

CB3. Students are able to integrate knowledge and handle complexity, and formulate judgments based on information that was incomplete or limited, include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgments.

### University of Lleida strategic competences

UDL2 - Master a foreign language.

UDL3 - Master Information and Communication Technologies.

### Degree-specific competences

CE11 - Capacity to design and develop computer systems, applications and services to built-in and ubiquitous systems

### Degree-transversal competences

EPS4 - Capacity to draft, design and implement projects and/or give novel solutions, using engineering-related tool

## Subject contents

### 1. Embedded Systems and Real Time Systems

- Introduction
- Characteristics of embedded systems
- Functional and temporary requirements
- Real time: Modeling, Scheduling, Design

### 2. Internet of Things

- Introduction
- Components and technological restrictions
- Connectivity and communication protocols

### 3. Edge Computing

- Introduction
- Requirements and opportunities
- Integrated machine learning

## Methodology

The course will be based on the development of a project following the SCRUM work methodology and will consist of:

- Sessions to present the contents of the agenda.
- Sessions in face-to-face format in which doubts will be solved and the contents of the subject will advance
- Sessions in face-to-face format, corresponding to the project Sprint.
  - Results presentation
  - Sprint Evaluation.
  - Sprint Review and Retrospective.

## Development plan

Week	Contents	Scheduling
1	Introduction to the subject. Presentation of the project to be developed. Definition of work groups and stages of the project	3h lecture/4.5h autonomous work
2	Embedded systems and RTOS. Evaluation of objectives. Development applied to the project.	3h lecture/4.5h autonomous work
3	Examples and practical work with the development environment	3h lecture/4.5h autonomous work
4	Internet of Things Evaluation of objectives. Development applied to the project	3h lecture/4.5h autonomous work
5	Communication protocols. development examples.	3h lecture/4.5h autonomous work
6	Edge computing. Design aspects and examples Development applied to the project.	3h lecture/4.5h autonomous work
7	Embedded Machine-Learning Development environment and samples Development applied to the project.	3h lecture/4.5h autonomous work
8	Project development	3h lecture/4.5h autonomous work
9	Final evaluation.	3h lecture/4.5h autonomous work

## Evaluation

### Evaluation

Block	Id	Activity	Weight	Minimum Grade	Group	Compulsory	Recovery
SPRINT1*	PeerAv	PeerAvaluation	5%	No	Yes	Yes	No
	GroupAv	Self Avaluation	5%	No	Yes	Yes	No
	ProfAv	Professor Avaluation	10%	No	Yes	Yes	No
SPRINT2*	PeerAv	PeerAvaluation	5%	No	Yes	Yes	No
	GroupAv	Self Avaluation	5%	No	Yes	Yes	No
	ProfAv	Professor Avaluation	10%	No	Yes	Yes	No
	PeerAv	PeerAvaluation	5%	No	Yes	Yes	No

SPRINT3*	GroupAv	Self Avaluation	5%	No	Yes	Yes	No
	ProfAv	Professor Avaluation	10%	No	Yes	Yes	No
Project	DOC	Documentation	10%	No	Yes	Yes	No
	DEV	Development and Results	20%	No	Yes	Yes	No
	DEF	Defense*	10%	No	Yes	Yes	No
(*) Implies an oral presentation							

## Alternative evaluation

Block	Id	Activity	Weight	Minimum Grade	Group	Compulsory	Recovery
Project	DOC	Documentation	30%	No	No	Yes	Yes
	DEV	Development and Results	40%	No	No	Yes	Yes
	DEF	Defense*	30%	No	No	Yes	Yes
(*) Implies an oral presentation							

## Bibliography

### Basic Bibliography

1. *Ubiquitous Computing Fundamentals*: John Krumm (ed.), CRC Press, 2010
2. *Smart Sensors to Network the World*: David E. Culler, Hans Mulder, Scientific American, Jun 2004.
3. *Designing the Internet of Things*: Adrian McEwen, Hakhim Cassimaly, Wiley, 2014

### Supplementary Bibliography

1. *Ubiquitous Computing: Smart Devices, Environments and Interactions*: Stefan Poland, Wiley, 2009

### Webgraphy

1. <https://www.scrum.org/> (v. 28/09/2020)
2. <https://www.freertos.org/> (v. 08/09/2021)
3. <https://nodemcu.readthedocs.io/en/release/> (v. 28/09/2020)
4. [developer.arm.com](https://developer.arm.com) (v. 28/09/2020)