Universitat Autònoma de Barcelona

2020/2021

Embedded Systems Design

Code: 102733
ECTS Credits: 6

Degree	Type	Year	Semester
2500895 Electronic Engineering for Telecommunication	OT	4	0

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

Contact

Name: Jordi Carrabina Bordoll
Email: Jordi.Carrabina@uab.cat

Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: Yes
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Teachers

Jordi Carrabina Bordoll
Marc Codina Barbera

Prerequisites

Folowing knowledge is recommended:

- C/C++ Programming

- Linux Operating System
- Technology of electronic components
- Electronic Systems and Applications
- Computer Architecture and Peripherals

Objectives and Contextualisation

The overall objective of this course is threefold:

1. Acquisition of criteria and techniques for the design of electronic systems (embedded).
2. Familiarisation with the usual components, interfaces, protocols, and software levels (BSP, HAL, MW, OS) and development tools.
3. Design of an embedded system on a prototyping platform

Competences

- Communication
- Develop personal attitude.
- Develop personal work habits.
- Develop thinking habits.

- Learn new methods and technologies, building on basic technological knowledge, to be able to adapt to new situations.
- Manage activities involved in projects in the field of telecommunications.
- Resolve problems with initiative and creativity. Make decisions. Communicate and transmit knowledge, skills and abilities, in awareness of the ethical and professional responsibilities involved in a telecommunications engineers work.
- Work in a team.

Learning Outcomes

1. Adapt to unforeseen situations.
2. Communicate efficiently, orally and in writing, knowledge, results and skills, both professionally and to non-expert audiences.
3. Design and use complex electronic systems that interact with external transduction elements, providing them with the necessary intelligence to operate in a subordinated and / or autonomous manner.
4. Develop critical thinking and reasoning.
5. Develop curiosity and creativity.
6. Develop systemic thinking.
7. Efficiently use ICT for the communication and transmission of ideas and results.
8. Generate innovative and competitive proposals in professional activity.
9. Obtain hardware / software solutions for communications applications using complex platform based interfaces.
10. Optimize embedded systems from design and choosing suitable design methodologies and implementation technologies.
11. Prevent and solve problems.
12. Work cooperatively.

Content

1. Technology of Complex HW/SW Embedded Systems

    1.1 Embedded HW/SW Systems
    1.2 From microcontrollers to SoCs (Systems-on-a-Chip)
    1.3 Homogeneous and heterogeneous Multiprocessor Systems
    1.4 Sensors and Microsystems

2. Platforms and Subsystems
    2.1. Industrial and Open embedded platforms
    2.2. Considerations on Mechanics, energy and Regulations
    2.3 Communications Subsystems
    2.4 Reconfigurable Devices for prototyping and implementation
    2.5 Memory Subsystem
3. Implementation of Embedded systems
    3.1 Clocks and Voltage Regulators
    3.2 Rules of good design
    3.3 Design, manufacture and Assembly of PCBs
    3.4 Cost estimate and industrialization
4. Seminars
    4.1 Design of high-performance PCBs
    4.2 Printed electronics
    4.3 Application examples (wearables, image processing, 3D, speech, etc.)

Methodology

Directed activities: lectures, seminars and laboratory sessions

Supervised Activities: design work (final session in the lab), tutoring, (optional) participation in an international challenge proposed by industries on embedded systems

Autonomous Activities: study, preparation of work and laboratory, writing reports and presentations

Design of an specific application system (in groups) using the synergy platform (or another coming from the challenge).

A visit to an industry related to the design and/or manufacture of embedded systems will be proposed.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Laboratory Sessions	12	0.48	4, 3, 10
Lessons	26	1.04	4, 3, 9, 10
Seminars on current trends	12	0.48	2, 4, 3, 10, 12
Type: Supervised			
Tutoring	12	0.48	4, 3, 9, 10
Type: Autonomous			
Preparation of Laboratory Sessions	8	0.32	4, 3, 9, 10
Study	68	2.72	2, 4, 3, 9, 10, 12

Assessment

Evaluation of the Course is based on the following weighting:

- Partial Control(s) and/or Final exam (50%)
- Laboratory work (30%)
- Design Work (20%)

The design work and laboratory work are compulsory in order to pass the course.

Any modification of this method of evaluation by circumstances not provided appropriate way will be communicated to the affected students.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Design development (groupal) on an embedded platform	20%	4	0.16	1, 2, 5, 4, 3, 7, 8, 9, 10, 12
Final Test	50%	2	0.08	2, 6, 4, 3, 9, 10, 12
Parcial control 1	25%	2	0.08	2, 5, 4, 3, 8, 9, 12
Parcial control 2	25%	2	0.08	2, 6, 5, 4, 3, 7, 9, 10, 12

Report on the results of the laboratory developments	30%	2	0.08	2, 3, 7, 9, 10, 11, 12

Bibliography

The material given to the supervised activities is self-explanatory.

Related web resources will be used with the current technologies.

To delve into the subject, you can consult the following bibliographic sources:

- F. Balarin et al.: "Hardware-Software Co-Design of Embedded Systems: The POLIS Approach".
- F. Hüning: Embedded Design for IoT with Renesas Synergy.
- Johnson, H.W., Graham m., "high-speed digital design: a handbook of black magic"

Example of international competition http://www.innovatefpga.com/portal/