Universitat Autònoma de Barcelona

2017/2018

Embedded Systems Design

Code: 102733
ECTS Credits: 6

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

Contact

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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
Quang Vinh Ngo
David Castells Rufas

Prerequisites

Folowing knowledge is recommended:

- Technology of electronic components
- Digital Systems and HW Description Languages
- Electronic Systems and Applications

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 components, interfaces and standard protocols.
3. Realization of the design of an embedded system.

Skills

- Communication
- Develop personal attitude.
- Develop personal work habits.
- Develop thinking habits.
- Learn new methods and technologies on the basis of basic and technological knowledge, and be versatile enough 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. Communicate efficiently, orally and in writing, knowledge, results and skills, both professionally and to non-expert audiences.
2. 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.
3. Develop critical thinking and reasoning.
4. Develop curiosity and creativity.
5. Develop systemic thinking.
6. Efficiently use ICT for the communication and transmission of ideas and results.
7. Generate innovative and competitive proposals in professional activity.
8. Obtain hardware / software solutions for communications applications using complex platform based interfaces.
9. Optimize embedded systems from design and choosing suitable design methodologies and implementation technologies.
10. Prevent and solve problems.
11. Work cooperatively.

Content

1. Technology of Complex HW/SW Embedded Systems

    1.1 Components
    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, tutoring, (optional) participation in international challenges from industries on embedded systems

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

A work (in groups) of HW design of a specific application system using standard components will be done in the course (can come from the challenge). It has reserved a total of 10 hours for the group discussion of the different phases of the work (1h initial discussion, 1h for clarification of specifications, 2h presentation of specifications (phase 1), 3 h of presentation of technological alternatives (phase 2), 4h of final presentation and discussion (phase 3)).

A visit to a company of design and/or manufacture of embedded systems will be proposed..

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Laboratory Sessions	12	0.48	3, 2, 9
Lessos	26	1.04	3, 2, 8, 9
Seminars on current trends	12	0.48	1, 3, 2, 9, 11
Type: Supervised			
Tutoring	12	0.48	3, 2, 8, 9
Type: Autonomous			
Preparation of Laboratory Sessions	8	0.32	3, 2, 8, 9
Study	68	2.72	1, 3, 2, 8, 9, 11

Evaluation

Evaluation of the Course is based on the following weighting:

Design Work (33%)

Laboratory work (33%)

Final exam 34%)

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.

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Document and presentation of Design work (Phase 1)	10	2	0.08	1, 4, 3, 2, 7, 11
Document and presentation of Design work (Phase 2)	10	4	0.16	1, 4, 3, 6, 7, 8, 9, 11
Document and presentation of Design work (Phase 3 Final)	13	2	0.08	1, 4, 3, 2, 6, 8, 11
Final Exam	34	2	0.08	1, 5, 3, 2, 8, 9, 10, 11

Laboratory Results Reports	33	2	0.08	1, 3, 2, 8, 9, 11

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:

l. Terés, y. Torroja, s. Olcoz, e. Villar: "VHDL: An electronic standard design". McGraw-Hill,

f. Balarin et al.: "Hardware-Software Co-Design of Embedded Systems: The POLIS Approach".

P. Bricaud, m. Keating: "Reuse Methodology Manual for System-On-A-Chip Designs".

Rajsuman, Rochit. " System-on-a-Chip: Design and Test ".

Johnson, H.W., Graham m., "high-speed digital design: a handbook of black magic"

Example of international competition http://www.innovateeurope.org/eu/