

Course guide

230916 - EMB - Embedded Systems

Last modified: 24/05/2024

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering.

Degree: BACHELOR'S DEGREE IN ELECTRONIC ENGINEERING AND TELECOMMUNICATION (Syllabus 2018).
(Compulsory subject).

Academic year: 2024 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: JORGE SALAZAR SOLER

Others: Segon quadrimestre:
DANIEL BARDES LLORENSI - 11, 12
OLIVER MILLÁN BLASCO - 13
JORGE SALAZAR SOLER - 11, 12, 13

PRIOR SKILLS

Basic analysis of electronic circuits.
Basic knowledge of digital electronics.
Knowledge of C programming.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

CE14. (ENG) GREELEC: Capacitat d'anàlisi i disseny de circuits combinacionals i seqüencials, sincrònons i asincrònons i d'utilització de microprocessadors i circuits integrats. (Mòdul comú a la branca de telecomunicació).

Generical:

CG2. (ENG) GEELEC: coneixement, comprensió i capacitat per explicar la legislació necessària durant el desenvolupament de la professió d'enginyer tècnic de telecomunicació i facilitat per al maneig d'especificacions, reglaments i normes d'obligat compliment.

Transversal:

CT6. (ENG) GREELEC: APRENTATGE AUTÒNOM: Detectar deficiències en el propi coneixement i superarles mitjançant la reflexió crítica i l'elecció de la millor actuació per ampliar coneixements.

CT3. (ENG) GREELEC: COMUNICACIÓ EFICAÇ ORAL I ESCRITA. Comunicar-se de forma oral i escrita amb d'altres persones sobre els resultats de l'aprenentatge, de l'elaboració del pensament i de la presa de decisions, participar en debats sobre el tema de la pròpia especialitat.

TEACHING METHODOLOGY

Lectures
Laboratory sessions
Team assignments (at home)
Individual work (at home)
Continuous assessment evaluation
Final assessment evaluation

LEARNING OBJECTIVES OF THE SUBJECT

Programming, analysis and design of microprocessor / microcontroller based systems.

STUDY LOAD

Type	Hours	Percentage
Hours small group	26,0	17.33
Self study	85,0	56.67
Hours large group	39,0	26.00

Total learning time: 150 h

CONTENTS

1.- Introduction

Description:

Subject description. Digital electronics context. Digital implementation options. Basic CPU system structure. Software execution.

Full-or-part-time: 5h

Theory classes: 2h

Self study : 3h

2.- Electrical compatibility

Description:

Static and dynamic characteristics. Requirements and performance parameters. Compatibility in interconnections. Buses. Usage of open collector/drain in busses.

Full-or-part-time: 14h

Theory classes: 6h

Self study : 8h

3.- The CPU

Description:

Control unit and datapath. Von Neumann and Harvard structures. Instruction cycle. Speed and power metrics. CPU optimization. External buses. Endianness.

Memory hierarchy. Cache memory. Protection and virtual memory.

Full-or-part-time: 18h

Theory classes: 8h

Self study : 10h

4.- Memory subsystem

Description:

Memory classification. Typical SRAM and ROM signals. Memory decoding in CPUs and MCUs. DRAM memories and others.

Full-or-part-time: 23h

Theory classes: 10h

Self study : 13h



5.- Timing

Description:

Time responses. Setup and Hold requirements. Timing evaluation in read/write operations. DRAM timing.

Full-or-part-time: 14h

Theory classes: 6h

Self study : 8h

6.- Input/Output

Description:

Peripheral connections. I/O map. Registers. Polling and interrupt synchronization. RSIs. Execution context. Masking. Latency. Exceptions. Peripheral examples: Timers, Converters, Communications.

Full-or-part-time: 16h

Theory classes: 7h

Self study : 9h

Laboratory

Description:

ARM Cortex M4 system development. Development environment. Peripheral access. Interrupts. Timing measurements. Threads.

Full-or-part-time: 60h

Laboratory classes: 26h

Self study : 34h

GRADING SYSTEM

50% Final exam

30% Laboratory sessions

20% Continuous assessment evaluation

In the reassessment exam, only the theory contents are reassessed, so the resulting grade from the reassessment will be:

70% Reassessment Exam

30% Previous laboratory work

BIBLIOGRAPHY

Basic:

- Clements, A. Microprocessor systems design: 68000 hardware, software, and interfacing. 3rd ed. Boston: PWS, 1997. ISBN 0534948227.
- Cabestany Moncusí, J. Disseny de sistemes digitals amb microprocessadors [on line]. 2a ed. Barcelona: Edicions UPC, 2000 [Consultation: 10/07/2019]. Available on: <http://hdl.handle.net/2099.3/36234>. ISBN 8483013657.

Complementary:

- Li, Q.; Yao, C. Real-Time concepts for embedded systems. San Francisco: CMPBooks, 2003. ISBN 1578201241.
- Tanenbaum, A.S.; Austin, T. Structured computer organization [on line]. 6th ed., int. ed. Boston: Pearson, 2013 [Consultation: 07/05/2020]. Available on: <https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=5173727>. ISBN 9780273775331.
- Catsoulis, J. Designing embedded hardware [on line]. 2nd ed. Beijing: O'Reilly, 2005 [Consultation: 10/07/2019]. Available on:



<https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=540710>. ISBN 9780596007553.