Course guides
230644 - ADS - Advanced Digital Systems

Last modified: 29/04/2020

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

Degree: MASTER'S DEGREE IN ELECTRONIC ENGINEERING (Syllabus 2013). (Compulsory subject).
MASTER'S DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Optional subject).
MASTER'S DEGREE IN ADVANCED TELECOMMUNICATION TECHNOLOGIES (Syllabus 2019). (Optional subject).

Academic year: 2020 **ECTS Credits:** 5.0 **Languages:** English

LECTURER

Coordinating lecturer: J. MANUEL MORENO ARÓSTEGUI

Others: JOAN CABESTANY MONCUSÍ
Moreno Arostegui, Juan Manuel

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Ability to apply synchronization techniques and use standard buses considering electrical aspects and protocols.
2. Ability to specify and develop embedded systems using RTOS.
3. Ability to design digital systems based on multi-processors, configurable processors and FPGAs with HDL languages and CAE tools.

Transversal:
4. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

5. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

6. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

TEACHING METHODOLOGY

- Lectures
- Laboratory classes
- Laboratory practical work
- Individual work (distance)
- Short answer test (Control)
- Extended answer test (Final Exam)

LEARNING OBJECTIVES OF THE SUBJECT

Learning objectives of the subject:

The aim of this course is to train students in methods of design complete digital system encompassing hardware and software components and also their interconnection. First the system architecture of a complex digital system is reviewed. Then the memory and interconnection models to be used are presented. Thereafter the main features of a real time operating system (RTOS) are considered. Afterwards, physical aspects related to the implementation of the system (synchronisation, clock and data recovery methods) are presented.

Learning results of the subject:

- Ability to specify, design networks, services, processes and applications of telecommunications in both a fixed, mobile, personal, local or long distance, with different bandwidths in multicast networks, including voice and data.
- Ability to apply both traffic engineering tools as planning tools, dimensioning and network analysis.
- Ability to analyse, model and implement new architectures, network protocols and communication interfaces and new network services and applications.
- Ability to analyse, model and apply advanced techniques both security, including cryptographic protocols, firewalls, and collection mechanisms, authentication and content protection.

STUDY LOAD

Type	Hours	Percentage
Self study	86,0	68.80
Hours large group	26,0	20.80
Hours small group	13,0	10.40

Total learning time: 125 h

CONTENTS

1. Introduction

Description:
- Trends in system on chip design
- System components
- Implementation alternatives

Full-or-part-time: 9h
Theory classes: 2h
Laboratory classes: 1h
Self study : 6h

2. Memory Design

Description:
- Scratchpads and cache memory
- SOC memory systems
- Board-based memory systems

Full-or-part-time: 15h
Theory classes: 4h
Laboratory classes: 1h
Self study : 10h

3. Communication architectures

Description:
- Bus-based communication architectures
- Communication architectures standards
- Networks on chip

Full-or-part-time: 43h
Theory classes: 8h
Laboratory classes: 5h
Self study : 30h

4. Real-time operating systems (RTOS)

Description:
- Multi-tasking and task scheduling
- Synchronisation of resource access
- Inter-task communication
- Interrupt handling

Full-or-part-time: 34h
Theory classes: 6h
Laboratory classes: 4h
Self study : 24h

5. Physical communication mechanisms

Description:
- Synchronisation
- Clock alignment
- Clock recovery

Full-or-part-time: 24h
Theory classes: 6h
Laboratory classes: 2h
Self study : 16h

ACTIVITIES

LABORATORY

Description:
- Use of embedded microprocessors with RTOS in configurable devices.
- System integration for communication applications.

EXERCISES

Description:
Exercises to strengthen the theoretical knowledge.

SHORT ANSWER TEST (CONTROL)

Description:
Mid term control.

EXTENDED ANSWER TEST (FINAL EXAMINATION)

Description:
Final examination.

GRADING SYSTEM

Final exam: 40%
Group assessments: 20%
Laboratory assessments: 40%

BIBLIOGRAPHY

Basic:
- Flynn, M.J.; Luk, W. Computer system design: system-on-chip [on line]. Cambridge, MA: Wiley, 2011 [Consultation: 21/04/2020]. Available on: https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=693260. ISBN 9781118009901.

Complementary:
- Pasricha, S.; Dutt, N. On-chip communication architectures: system on chip interconnect. Amsterdam ; Boston: Elsevier / Morgan Kaufmann Publishers, 2008. ISBN 9780123738929.
- Dally, W.J.; Poulton, J.W. Digital systems engineering. Cambridge: Cambridge University Press, 1998. ISBN 0521592925.
- Moyer, B. (ed.). Real world multicore embedded systems [on line]. Elsevier, 2013 [Consultation: 21/04/2020]. Available on: https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=1138206. ISBN 9780123914613.