Course guide
320109 - PD - Digital Processors

Last modified: 19/04/2023

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering.

Degree: BACHELOR'S DEGREE IN AUDIOVISUAL SYSTEMS ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: Manuel Lamich Arocas

Others: Mon González, Jaume Garcia Díaz, Joel Invers Brunet

PRIOR SKILLS

Students who wish to take this subject are strongly recommended to have passed the Digital Electronics and Signals and Systems subjects.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CE06-ESAUD. Ability to autonomously learn new knowledge and techniques suitable for the conception, development, or exploitation of telecommunications systems and services. (Common module for the telecommunications branch)
CE14-ESAUD. Ability to analyze and design combinational and sequential circuits, synchronous and asynchronous, and to use microprocessors and integrated circuits. (Common module for the telecommunications branch)

Generical:
CG04-ESAUD. Ability to solve problems with initiative, decision-making, creativity, and to communicate and transmit knowledge, skills, and abilities, understanding the ethical and professional responsibility of the Technical Telecommunications Engineer's activity.

TEACHING METHODOLOGY

- Face-to-face lecture sessions.
- Face-to-face practical work sessions.
- Independent learning and exercises.
- Preparation and completion of group activities subject to assessment.

In the face-to-face lecture sessions, the lecturer will introduce the basic theory, concepts and results for the subject and use examples to facilitate students' understanding.
Practical class work will be covered in three types of sessions:
a) Sessions in which the lecturer guides students in performing practicals (80%)
b) Sessions in which students give presentations of group work (12%)
c) Examination sessions (8%)
Students will be expected to study in their own time so that they are familiar with concepts and are able to solve the exercises set, whether manually or with the help of a computer.
Students will prepare assignments in groups of 5 for presentation at laboratory sessions.

LEARNING OBJECTIVES OF THE SUBJECT

On completing this subject, students should be capable of using digital devices in image-processing and sound-processing applications. They will therefore be equipped with basic knowledge regarding the functioning of these devices and their peripherals and will also learn to use these systems. They will use DSP programming software to resolve set problems and build on the specific and transversal competences associated with coursework, as described below.

STUDY LOAD

Type	Hours	Percentage
Self study	90,0	60.00
Hours small group	45,0	30.00
Hours large group	15,0	10.00

Total learning time: 150 h

CONTENTS

TOPIC 1: MICROPROCESSOR-BASED SYSTEMS

Description:
1.1. Introduction to processors
1.2. Structure of a microprocessor-based system
1.3. Harvard and Von-Newman architectures
1.4. Advanced processor architectures

Related activities:
Theory class
Activity 1: Mid-semester test

Full-or-part-time: 11h
Theory classes: 2h
Laboratory classes: 3h
Self study : 6h

TOPIC 2: INTRODUCTION TO PROGRAMMING ENVIRONMENTS (INTEGRATED DEVELOPMENT ENVIRONMENTS, IDE)

Description:
2.1. Code Composer Studio (CCStudio) software
2.2. Real-time simultaneous processes. DSP BIOS
2.3. Example application using CCStudio (reverberation/echo)

Related activities:
Theory class
Activity 1: Mid-semester test
Activity 3: DSP programming

Full-or-part-time: 11h
Theory classes: 1h
Laboratory classes: 6h
Self study : 4h

TOPIC 3: INTRODUCTION TO DSP-BASED SYSTEMS

Description:
3.1. The need for signal processors. What is DSP?
3.2. History of signal processors
3.3. Advanced processor architectures
3.4. Current signal processor families (DSP)
3.5. Main differences between DSP and general processors (GP)
3.6. Basic DSP selection criteria

Related activities:
Theory class
Activity 1: Mid-semester test
Activity 3: DSP programming

Full-or-part-time: 10h
Theory classes: 1h
Laboratory classes: 3h
Self study : 6h

TOPIC 4: HARDWARE ENVIRONMENT

Description:
4.1. DSK TMS320C6711/6713 board
4.2. DSP block diagram
4.3. Internal DSP
4.4. DSK board block diagram
4.5. DSK board peripherals
4.6. Examples of basic functioning

Related activities:
Theory class
Activity 1: Mid-semester test
Activity 3: DSP programming

Full-or-part-time: 40h
Theory classes: 4h
Laboratory classes: 12h
Self study : 24h

TOPIC 5: CONNECTING NEW PERIPHERALS TO DSK

Description:
5.1. Connecting audio codecs
5.2. AIC 23
5.3. McBSP and McASP
5.4. Example of a board with PCM3003
5.5. DMA/EDMA

Related activities:
Theory class
Activity 2: End-of-semester test
Activity 3: DSP programming
Activity 4: Connection and configuration of the DSP system for communication with an external peripheral (codec)

Full-or-part-time: 71h
Theory classes: 6h
Laboratory classes: 21h
Self study : 44h

ACTIVITIES

(ENG) TÍTOL DE L'ACTIVITAT 1: PROVA PARCIAL

Full-or-part-time: 6h
Theory classes: 1h
Self study: 5h

(ENG) TÍTOL DE L'ACTIVITAT 2: PROVA FINAL

Full-or-part-time: 6h
Theory classes: 1h
Self study: 5h

(ENG) TÍTOL DE L'ACTIVITAT 3: PROGRAMACIÓ DE DSP

Full-or-part-time: 50h
Laboratory classes: 30h
Self study: 20h

(ENG) TÍTOL DE L'ACTIVITAT 4: CONNEXIÓ I CONFIGURACIÓ DEL SISTEMA DSP PER LA COMUNICACIÓ AMB UN PERIFÈRIC EXTERN (CODEC)

Full-or-part-time: 40h
Laboratory classes: 3h
Guided activities: 6h
Self study: 31h

GRADING SYSTEM

Continuous assessment:
- All face-to-face or online activities will be evaluated at the individual and group levels.
- 40% of the final grade will be awarded as a result of evaluating continuous activities undertaken face-to-face and online during the course.
- 45% of the final grade will be awarded on the basis of grades awarded for the examinations sat as part of the first and second assessment.
- The remaining 15% refers to assessment of formal aspects of all the activities undertaken during the course in terms of communication quality and skill.

For those students who meet the requirements and submit to the reevaluation examination, the grade of the reevaluation exam will replace the grades of all the on-site written evaluation acts (tests, midterm and final exams) and the grades obtained during the course for lab practices, works, projects and presentations will be kept.
If the final grade after reevaluation is lower than 5.0, it will replace the initial one only if it is higher. If the final grade after reevaluation is greater or equal to 5.0, the final grade of the subject will be pass 5.0.

BIBLIOGRAPHY

Basic:
- Manuals de Texas Instruments de la familia C6000.
- Barrero, Federico J.; Toral, Sergio L.; Ruiz, M. Procesadores digitales de señal de altas prestaciones de Texas Instruments: de la familia TMS320C3x a la TMS320C6000 [on line]. Madrid: McGraw-Hill, 2005 [Consultation: 30/09/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=3963. ISBN 8448198344.

Complementary:
- Chassaing, Rulph. Digital signal processing and applications with the TMS320C6713 and TMS320C6416 DSK [on line]. 2nd ed. New York: John Wiley & Sons, 2008 [Consultation: 15/06/2022]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=362017. ISBN 9780470138663.
- Kehtarnavaz, Nasser. DSP system design: using the TMS320C6000. Prentice Hall: Upper Saddle River, 2001. ISBN 0130910317.
- Kehtarnavaz, Nasser. C6X-based digital signal processing. Upper Saddle River: Prentice Hall, 2000. ISBN 0130883107.
- Dahnoun, Naim. DSP implementation using the TMS320C6000 DSP platform. Harlow: Prentice Hall, 2000. ISBN 0201619164.
- Chassaing, Rulph. DSP applications using C and the TMS320C6x DSK. New York: John Wiley & Sons, 2002. ISBN 0471207543.