320109 - PD - Digital Processors

Coordinating unit: 205 - ESEIAAT - Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering
Academic year: 2019
Degree: BACHELOR'S DEGREE IN AUDIOVISUAL SYSTEMS ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
ECTS credits: 6
Teaching languages: Catalan, Spanish

Teaching staff

Coordinator: 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:
3. AUD_COMMON: Ability to get new knowledge and to learn new techniques appropriate to the conception, development and exploitation of telecommunication systems and services.
4. AUD_COMMON: The ability to analyse and design combinational, sequential, synchronous and asynchronous circuits and to use integrated-circuit microprocessors.

Transversal:
1. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.
2. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.

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.

<table>
<thead>
<tr>
<th>Study load</th>
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<tbody>
<tr>
<td><strong>Total learning time:</strong> 150h</td>
<td>Hours large group:</td>
<td>15h</td>
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<tr>
<td></td>
<td>Hours medium group:</td>
<td>0h</td>
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<td></td>
<td>Hours small group:</td>
<td>45h</td>
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<tr>
<td></td>
<td>Self study:</td>
<td>90h</td>
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<tr>
<th>TOPIC 1: MICROPROCESSOR-BASED SYSTEMS</th>
<th>Learning time: 11h</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 2h</td>
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<tr>
<td></td>
<td>Laboratory classes: 3h</td>
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<tr>
<td></td>
<td>Self study: 6h</td>
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**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

<table>
<thead>
<tr>
<th>TOPIC 2: INTRODUCTION TO PROGRAMMING ENVIRONMENTS (INTEGRATED DEVELOPMENT ENVIRONMENTS, IDE)</th>
<th>Learning time: 11h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 1h</td>
</tr>
<tr>
<td></td>
<td>Laboratory classes: 6h</td>
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<tr>
<td></td>
<td>Self study: 4h</td>
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</tbody>
</table>

**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
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## TOPIC 3: INTRODUCTION TO DSP-BASED SYSTEMS

**Learning time:** 10h  
- Theory classes: 1h  
- Laboratory classes: 3h  
- Self study: 6h

### 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

## TOPIC 4: HARDWARE ENVIRONMENT

**Learning time:** 40h  
- Theory classes: 4h  
- Laboratory classes: 12h  
- Self study: 24h

### 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
**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)

**Learning time:** 71h
- Theory classes: 6h
- Laboratory classes: 21h
- Self study: 44h

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**Planning of activities**

<table>
<thead>
<tr>
<th>(ENG) TÍTOL DE L'ACTIVITAT 1: PROVA PARCIAL</th>
<th>Hours: 6h</th>
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<tbody>
<tr>
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<td>Theory classes: 1h</td>
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<td>Self study: 5h</td>
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<table>
<thead>
<tr>
<th>(ENG) TÍTOL DE L'ACTIVITAT 2: PROVA FINAL</th>
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<td>Self study: 5h</td>
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<thead>
<tr>
<th>(ENG) TÍTOL DE L'ACTIVITAT 3: PROGRAMACIÓ DE DSP</th>
<th>Hours: 50h</th>
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<td>Self study: 20h</td>
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<tr>
<th>(ENG) TÍTOL DE L'ACTIVITAT 4: CONNEXIÓ I CONFIGURACIÓ DEL SISTEMA DSP PER LA COMUNICACIÓ AMB UN PERIFÈRIC EXTERN (CODEC)</th>
<th>Hours: 40h</th>
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<tbody>
<tr>
<td></td>
<td>Laboratory classes: 3h</td>
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<td></td>
<td>Guided activities: 6h</td>
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<td>Self study: 31h</td>
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Qualification 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.

Complementary:


Others resources: