VNIVERSITAT DE VALÈNCIA

Course Guide
44279 Digital signal processing in real time

COURSE DATA

Data Subject	
Code	44279
Name	Digital signal processing in real time
Cycle	Master's degree
ECTS Credits	3.0
Academic year	2020 - 2021

Study (s)

Degree	Center	Acad. year	Period
2199 - M.D. in Electronic Engineering	School of Engineering	1	Second term

Subject-matter

Degree	Subject-matter	Character
2199 - M.D. in Electronic Engineering	1 - Digital signal processing	Obligatory

Coordination

Name	Department
FRANCES VILLORA, JOSE VICENTE	242 - Electronic Engineering
GUERRERO MARTINEZ, JUAN FCO	242 - Electronic Engineering

SUMMARY

This matter describes the possibilities for the hardware implementation of real-time digital signal processing. Thus, are described techniques of data processing that optimize performance of real-time execution, main architectures, main development tools and several levels of optimization.

On the practical side, the hardware implementation using the DSP processor is used, also its programming and the extraction of execution performance. In the lab students work over real systems and real applications, mainly audio, control and biomedical applications.

Apart of theoretical contents, this matter will provide the student with the necessary general knowledge for engineering problems resolution.

This is a obligatory matter, with a total of 3 ECTS. The workload for the student is 75 hours: 30 of in-person class and 45 of individual work.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

It is recommended that the student knows the basical theory of digital signal processing and have basical knowledge about processors architecture and programming.

OUTCOMES

2199 - M.D. in Electronic Engineering

- Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.
- Students should be able to integrate knowledge and address the complexity of making informed judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments.
- Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.
- Students should demonstrate self-directed learning skills for continued academic growth.
- Take into account the economic and social context in engineering solutions, be aware of diversity and multiculturalism and ensure sustainability and respect for human rights and equality between men and women.
- Diseñar un sistema, componente o proceso que cumpla unas especificaciones desde diferentes puntos de vista: electrónico, económico, social, ético y medioambiental.
- Demostrar una comprensión sistemática de un campo de estudio y el dominio de las habilidades.
- Realizar un análisis crítico, evaluación y síntesis de ideas nuevas y complejas.
- Ser capaz de fomentar, en contextos académicos y profesionales, el avance tecnológico, social o cultural dentro de una sociedad basada en el conocimiento.
- Capacidad para proyectar, calcular y diseñar productos, procesos e instalaciones en todos los ámbitos de la Ingeniería Electrónica y en particular los de tratamiento de la señal, sistemas digitales y de comunicaciones y electrónica industrial.
- Capacidad para el modelado matemático, cálculo y simulación en todos los ámbitos relacionados con la Ingeniería Electrónica y campos multidisciplinares afines. En especial los de tratamiento de la señal, sistemas digitales y de comunicaciones y electrónica industrial.
- Conocer las técnicas avanzadas de análisis de datos.

- Capacidad de analizar, especificar y diseñar sistemas de tratamiento digital de señales desde su concepción hasta su implementación en sistemas hardware de tiempo real..

LEARNING OUTCOMES

Once attended this matter, the student will have sufficient elements of judgment and the capacity to establish the advantages and disadvantages of the use of different technological alternatives for the real-time implementation of any digital processing algorithm. In addition, the students will be able to use developments tools for practical implementation of real-time applications.

DESCRIPTION OF CONTENTS

1. Introduction

1.1 Introduction.
1.2 Applications and market.

2. Architecture' basic elements

2.1 Basical hardware elements of architecture.
2.2 Alternatives to the real time hardware implementation.

3. Advanced DSP architectures

3.1 Superscalar organization concepts.
3.2 Superscalar DSP processors.
3.3 Multiprocessor systems.
3.4 Description of TI C6000 family.

4. Code optimization

4.1 Types of code optimization.
4.2 Comparison of performance of several optimization techniques.

5. Development of applivations on DSP processor

5.1 Development tools.
5.2 Language and programming.
5.3 Applications development.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	15,00	100
Laboratory practices	15,00	100
Development of group work	10,00	0
Study and independent work	10,00	0
Readings supplementary material	5,00	0
Preparation of evaluation activities	10,00	0
Preparing lectures	5,00	0
Preparation of practical classes and problem	5,00	0
TOTAL	**75,00**	

TEACHING METHODOLOGY

The teaching methods employed in the development of the course are:

a) Theoretical activities.

In the theoretical sessions will be used the exposition of the matter using several audiovisual media.

b) Practical activities.

Practical sessions are tightly related with theory sessions. These are organized about design and implementation of real-time DSP processing applications. Student will have necessary materials before the session, and the realization will be done under the teacher supervision and guidance.

c) Student's personal work.

Outside the classroom the student will do the preparation of classes and exams (study). Also will look the documentation up and elaborate work in grups.

We will use e-learning platforms ("Aula Virtual") to support communication with students. Through it, the student will have access to course materials used in class, as well as solving problems and exercises.

EVALUATION

The evaluation of the course will be conducted by performing:

- A short questions individual examination on theoretical contents.

- A practical individual test that will be required the development of a real-time application.

- Two grupal works, as a mode of inform, that will consist on the complete resolution of a real application over real signals

REFERENCES

Basic

- Chassaing, R.; Reay, D. "Digital Signal Processing and Applications with the TMS320C6713 and TMS320C6416 DSK". Willey-IEEE Press. 2ª Edición. 2008.
- Lapsley, P. "DSP Processor Fundamentals : Architectures and Features". IEEE Press. 1997.
- Stallings, W. Organización y arquitectura de computadores, Quinta edición. Prentice-Hall. 2000
- Hennessy, J.L.; Patterson D.A.; Arpaci-Dusseau A.C. "Computer arquitecture: a quantitative approach".
- Embree, P.M.; Danieli, D. "C++ Algorithms for Digital Signal Processing". Prentice Hall. 1999.

Additional

- Grover, D.; Deller, J.R. "Digital Signal Processing and the Microcontroller". Prentice Hall. 1999.
- Guerrero, J.F. Introducción a los procesadores digitales de señal. Moliner. 2000.
- Bateman, A.; Patterson-Stephens, I. "The DSP Handbook". Prentice Hall. 2002.

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

English version is not available