# COURSE DATA

## DATA SUBJECT

**Code:** 44279
**Name:** Digital signal processing in real time
**Cycle:** Master's Degree / Doctorate
**ECTS Credits:** 3
**Academic year:** 2026-27

## STUDY (S)

| Degree | Center | Acad. year | Period |
|---|---|---|---|

## SUBJECT-MATTER

| Degree | Subject-matter | Character |
|---|---|---|

## COORDINATION

FRANCES VILLORA JOSE VICENTE

# 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.

## COMPETENCES / LEARNING OUTCOMES

### 2199 -

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

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.

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.

Conocer las técnicas avanzadas de análisis de datos.

Demostrar una comprensión sistemática de un campo de estudio y el dominio de las habilidades.

Diseñar un sistema, componente o proceso que cumpla unas especificaciones desde diferentes puntos de vista: electrónico, económico, social, ético y medioambiental.

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.

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.

## 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

### PRESENCIAL ACTIVITIES

| Activity | Hours |
|---|---|
| Total hours | 0,00 |

### NON PRESENCIAL ACTIVITIES

| Activity | Hours |
|---|---|
| Attendance at other activities | 0,00 |
| Individual or group project | 0,00 |
| Independent study and work | 15,00 |

| | |
|---|---|
| Preparation of lessons | 10,00 |
| Preparation for assessment activities | 10,00 |
| Resolution of case studies | 10,00 |
| **Total hours** | **45,00** |

## 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.

Out of the classroom, the student will prepare classes, exams and activities.

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 subject will consist of a written test, with theoretical and practical questions, and laboratory.

## REFERENCES


- 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 arquiteccture: a quantitative approach".
- 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.
- Embree, P.M.; Danieli, D. "C++ Algorithms for Digital Signal Processing". Prentice Hall. 1999.