

**COURSE DATA****Data Subject**

<b>Code</b>	46793
<b>Name</b>	Procesado de la señal y los datos
<b>Cycle</b>	Master's degree
<b>ECTS Credits</b>	4.5
<b>Academic year</b>	2024 - 2025

**Study (s)**

<b>Degree</b>	<b>Center</b>	<b>Acad. Period year</b>
2269 - Master's Degree in Electronic Engineering	School of Engineering	1 Annual

**Subject-matter**

<b>Degree</b>	<b>Subject-matter</b>	<b>Character</b>
2269 - Master's Degree in Electronic Engineering	4 - Tratamiento Digital de Señales	Obligatory

**Coordination**

<b>Name</b>	<b>Department</b>
MARTIN GUERRERO, JOSE DAVID	242 - Electronic Engineering

**SUMMARY**

This course presents the most usual techniques for data and signal processing. In particular, the structure of the course consists of three main blocks.

The first one deals with a review of digital signal processing, as a necessary step to study how to process signals from a probabilistic and statistical point of view.

The second part of the course will be a basic introduction of exploratory data analysis.

Finally, a review of digital filtering will be carried out, with special emphasis on advanced techniques, such as optimal and adaptive filtering that will naturally lead to neural models and other machine learning approaches.



Different lab sessions will be performed to complement the theoretical tuition.

## PREVIOUS KNOWLEDGE

### Relationship to other subjects of the same degree

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

### Other requirements

No one. The bachelors degree to access the master ensures the basic knowledge to follow the course correctly.

## COMPETENCES (RD 1393/2007) // LEARNING OUTCOMES (RD 822/2021)

### LEARNING OUTCOMES (RD 1393/2007) // NO CONTENT (RD 822/2021)

The learning outcomes are settled on a number of contents (Con) and skills (Sk1), as specified in the syllabus, namely:

Con4 – Knowledge of the advanced techniques for data and digital signal processing, from their conception to their implementation in real-time hardware systems.

Con5 – Interpretation of technical and regulatory documentation of equipment and systems in the sphere of Electronic Engineering and related multidisciplinary fields.

Sk11 – Identification, formulation and solution of problems in the sphere of Electronic Engineering and related multidisciplinary fields.

Sk12 – Mathematical modeling and simulation in the sphere of Electronic Engineering and related multidisciplinary fields.

Sk13 – Planning, calculation and design of products, processes and systems in the sphere of Electronic Engineering and related multidisciplinary fields.

Sk14 – Use of specialized software and hardware, as well as design frameworks, simulation and programming in the sphere of Electronic Engineering and related multidisciplinary fields.

Sk15 – Design of systems and processes to comply specifications from different perspectives: electronic, regulatory, economic, social, ethical and environmental.



## DESCRIPTION OF CONTENTS

### 1. Digital Signal Processing

1. Review of digital signal processing
  - 1.1. Sampling and aliasing
  - 1.2. Z-transform
2. Probability
3. Statistics
4. Information theory

### 2. Exploratory Data Analysis

1. Missing values and outliers
2. Dimensionality reduction
3. Descriptive Statistics
4. Normalization and coding
5. Visualization

### 3. Digital Filtering

1. Review of digital filtering: zeros and poles in the Z-plane
2. Optimal digital filtering: Wiener filter
3. Adaptive filtering

### 4. Machine Learning

1. Supervised learning
  - 1.1 Linear models
  - 1.2 Nonlinear models
    - 1.2.1 Neural networks
    - 1.2.2 Support vector machines
    - 1.2.3 Decision trees
2. Unsupervised learning
3. Other types of learning

**WORKLOAD**

ACTIVITY	Hours	% To be attended
Theory classes	25,00	100
Laboratory practices	20,00	100
Development of group work	10,00	0
Development of individual work	5,00	0
Study and independent work	20,00	0
Readings supplementary material	2,50	0
Preparation of evaluation activities	20,00	0
Preparing lectures	5,00	0
Preparation of practical classes and problem	5,00	0
<b>TOTAL</b>	<b>112,50</b>	

**TEACHING METHODOLOGY**

- Master class with examples of practical use cases.
- Guided lab exercises to be solved by the students.
- Flipped classroom.

**EVALUATION**

The grade will be obtained as follows:

- SE1 (50%): Final examination with theoretical and/or practical questions. A minimum grade of 5 (out of 10) in this part will be needed to pass the course.
- SE2 (50%): Evaluation of practical tasks by means of deliverables, oral presentations and/or other tests.

Copying or plagiarism of any activity that is part of the evaluation will result in the impossibility of passing the course, and the student will then be subject to the appropriate disciplinary procedures indicated in the ACTION PROTOCOL FOR FRAUDULENT PRACTICES AT THE UNIVERSITY OF VALENCIA ([ACGUV 123/2020](#)).

In any case, the system of evaluation will be ruled by the established in the Regulation of Evaluation and Qualification of the University of Valencia for Degrees and Masters.

(<https://webges.uv.es/uvTaeWeb/MuestraInformacionEdictoPublicoFrontAction.do?accion=inicio&idEdictoSeleccionado=5639>).



## REFERENCES

### Basic

- Tratamiento Digital de Señales. Principios Algoritmos y Aplicaciones. / John G. Proakis, Dimitris G. Manolakis, Prentice Hall, 2008.
- Statistical and Adaptive Signal Processing: Spectral Estimation, Signal Modelling, Adaptive Filtering & Array Processing. D. Manolakis, V.K. Ingle, S.M. Kogon. Artech House 2005.
- Análisis de datos experimentales. Emilio Soria, José D. Martín, Antonio J. Serrano, Daniel Aguado. Universidad Politécnica de Valencia, 2007.
- Machine Learning. Ethem Alpaydin, MIT Press, 2009.