

**COURSE DATA****DATA SUBJECT****Code:** 36420**Name:** Signals and systems**Cycle:** Undergraduate Studies**ECTS Credits:** 6**Academic year:** 2025-26**STUDY (S)**

| Degree                        | Center                               | Acad. year | Period        |
|-------------------------------|--------------------------------------|------------|---------------|
| 1406 - Degree in Data Science | Escola Tècnica Superior d'Enginyeria | 2          | First quarter |

**SUBJECT-MATTER**

| Degree                        | Subject-matter | Character  |
|-------------------------------|----------------|------------|
| 1406 - Degree in Data Science | Signals        | COMPULSORY |

**COORDINATION**

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**SUMMARY**

In Signals and Systems students learn a series of concepts and techniques for working with signals that have a certain temporal and/or spatial structure, such as biosignals (ECG, EEG, etc) and images. As these data appear frequently, it is important that data scientists know them.

The mathematical foundations for handling this type of data (transformed Z and Fourier) and the associated operations for treating them (convolution / correlation) are developed.

The theory classes will be taught in Spanish. The language for the practical and laboratory classes will be stated in the course guidelines available on the website for this degree.

**PREVIOUS KNOWLEDGE****RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE**



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

## OTHER REQUIREMENTS

Given the basic nature of this course and its position in the curriculum, the only prerequisites are those stipulated for admission to the degree.

## COMPETENCES / LEARNING OUTCOMES

### 1406 - Degree in Data Science

(CB3) Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration.

(CB4) Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences.

(CE10) Ability to digitally process signals and extract information from them.

(CG01) Knowledge of basic subjects and technologies that enable students to learn new methods and technologies, and to provide them with versatility to adapt to new situations.

(CG02) Ability to solve problems with initiative and creativity and to communicate and transmit knowledge, abilities and skills, which should include the ethical and professional responsibility of the activity of a data scientist.

(CT02) To be able to complete technical, scientific, social and human training in general, and to organise self-learning with a high degree of autonomy.

(CT04) To be responsible for ones own professional development and specialisation, applying the acquired knowledge in the identification of career opportunities and sources of employment.

## DESCRIPTION OF CONTENTS

### 1. Introduction

Signals. Definition. Types.  
Energy and power.  
Systems. Definition. Types.  
LTI systems. Examples.

Equation in differences.  
Impulsional response.



## 2. Analysis in the time domain

Equation in differences.  
Convolution. Examples. Properties  
Autocorrelation and cross correlation.

## 3.

Z transform. Definition and properties.  
Use to process signals.  
Use to implement systems. Structures

## 4. Fourier transform

Fourier series. Fourier transform. Inverse transformations.  
Fourier transform in discrete time. Inverted transformations.  
Frequency response.

## 5. Digital filters

Digital filters. Types and use.  
Design by poles and zeros of the Z Transform. Examples.  
Other types of design. Examples

## 6. Laboratory practice

Due to its importance in the subject, it has been considered convenient to include as an independent thematic unit the practices to be carried out in the laboratory (computer room), where the student will learn to implement the models described in the theory classes.

Six laboratory practices are proposed, corresponding to the theoretical contents previously described in the previous thematic units:

Session I: Introduction to R y Conversion A/D y D/A

Session II: Analysis of systems in the time domain

Session III: Transformations for the analysis of linear systems

Session IV: Fourier transform

Session V: Analysis of signals in temporal and frequency domains

Session VI: Digital Filters

## WORKLOAD

## PRESENCIAL ACTIVITIES



| Activity            | Hours        |
|---------------------|--------------|
| Theory              | 28,00        |
| Laboratory          | 20,00        |
| Classroom practices | 12,00        |
| <b>Total hours</b>  | <b>60,00</b> |

### NON PRESENCIAL ACTIVITIES

| Activity                              | Hours        |
|---------------------------------------|--------------|
| Attendance at other activities        | 0,00         |
| Individual or group project           | 15,00        |
| Independent study and work            | 25,00        |
| Preparation of lessons                | 20,00        |
| Preparation for assessment activities | 30,00        |
| Resolution of case studies            | 0,00         |
| <b>Total hours</b>                    | <b>90,00</b> |

### TEACHING METHODOLOGY

**Theory lessons:** In the theory lessons, the concepts will be explained and illustrated with examples, sometimes by computer. Standard procedures for solving problems related to this course will be explained (MD1, developed competences: CB3, CB4, CG01, CT02, CT04,CE10).

**Problem lessons:** Most exercises will be solved by the students themselves or by the teacher during problem lessons. Work conducted in these lessons may be evaluated as a component of the student's final grade. (MD2, developed competences: CB3, CB4, CG01, CG02, CE010).

**Laboratory lessons:** In these lessons, computer tools will be used to state and solve problems related to the course. Work conducted in these lectures will be taken into account for the student's final grade (MD4, developed competences: CB3, CB4, CG01, CT02, CT04,CE10)

### EVALUATION

Students will be evaluated as follows:

- There will be a final exam of a fundamentally practical nature with a 50% weighting on the final mark. In order to pass the course it is necessary to obtain a minimum qualification of 4 points (out of 10) in this exam. Students who do not reach this minimum qualification in the final exam will have a \"failing\" grade and their final qualification will not exceed 4 points. Students who do not pass the subject in the first call will have a new final exam on the day of the second call under the same conditions. (SE1, competences evaluated: CB3, CB4, CG01, CG02, CT02, CT04, CE010)

- The 30 % of the qualification corresponds to the computer laboratory classes. The laboratory grade will be obtained as a result of evaluating each practice and a final, individual, practical test of the same characteristics as the practices carried out, which will take place in the last practice session. The continuous evaluation of each practice (preparation 30% and completion 70%) will constitute 40% of the



final laboratory note, while the remaining 60% will be obtained from the completion of the individual final test. In order to be able to take the final test, it is necessary to have attended the laboratory practices. It will be necessary to obtain a 4 out of 10 in this mark to be able to pass the course. For students who do not obtain a 4 or more attending the laboratories there will be two more convocations on the dates and times officially designated by the center for the official examination of the subject, after the theory exam. The laboratory exam grade obtained in this way will be 100% of the laboratory grade. For organizational reasons, teachers may require prior registration for this test, which would be announced well in advance. (SE2/SE3, competences evaluated: CB3, CB4, CG01, CG02, CT02, CT04, CE10)

- The 20 % of the grade is obtained by continuous student evaluation carried out through the use of assignments and online questionnaires that are done after theory classes. This part of the grade is not recoverable in the second call. Students who do not pass the subject in the first call will use in the second call the grade obtained in this part in the first call. (SE2/SE3, competences evaluated: CB1, CB2, CG01, CG05, CT03, CE01)

Copying or plagiarism or any other fraudulent practice in 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 all cases the evaluation system will be governed by the University of Valencia's regulations on grading and assessment for bachelor's degrees and master's degrees, which is available at:

[http://www.uv.es/graus/normatives/2017\\_108\\_Reglament\\_avaluacio\\_qualificacio.pdf](http://www.uv.es/graus/normatives/2017_108_Reglament_avaluacio_qualificacio.pdf)

## REFERENCES

- S. S. Soliman, M. A. Rodríguez Hernández, M. Srinath and A. Torres Suárez, Señales y Sistemas Continuos y Discretos. ,2 , última reimpr ed.Madrid etc.: Prentice Hall, 2000, pp. 542. ISBN: 8483221543
- A. V. Oppenheim, S. H. Nawab and A. S. Willsky, Señales y Sistemas. ,2 ed.México etc.: Prentice-Hall Hispanoamericana, 1998, pp. 956. ISBN:970170116X
- H. P. Hsu, Schaum's Outline of Theory and Problems of Signals and Systems. New York etc.: McGraw-Hill, 1995, pp. 466. ISBN:0070306419
- John G. Proakis & Dimitris G. Manolakis. Tratamiento digital de señales. ISBN: 978-84-8322-347-5



- Emilio Soria Olivas & Marcelino Martínez Sober & Jose & Vicente Frances Villora & Gustavo Camps i Valls. Problemas de tratamiento digital de señales. Prentice-Hall.