1. OVERVIEW

Subject area	Signal and Image Processing
Degree	Bachelor's Degree in Physics
School/Faculty	Architecture, Engineering and Design
Year	Third
ECTS	6 ECTS
Type	Optional
Language(s)	Spanish
Delivery mode	On campus
Semester	Second semester

2. INTRODUCTION

This subject area belongs to the group of elective subject areas on the speciality pathways (Materials, Electronics, and Computing and Data Analysis) for the Bachelor's Degree in Physics. The aim of this subject area is to familiarise students with the processing techniques for both one-dimensional signals and two-dimensional images. During the subject area, students will learn:

- To represent signals in both the time domain and the frequency domain, using the Fourier transform.
- To use mathematical tools and transformations in the analysis of sampling and the reconstruction of any signal.
- To process signals or images using the most suitable mathematical tools or software to achieve the desired results.

3. SKILLS AND LEARNING OUTCOMES

Key skills (CB, by the acronym in Spanish):

- CG2 - Ability to plan and perform independent work when managing projects associated with different areas of physics.
- CG4 - To convey knowledge, procedures, results and scientific ideas in the field of physics, both orally and in writing.
- CG5 - To understand diverse phenomena that, despite being physically different, share certain similarities, allowing known solutions to be applied to new problems.
- CB2 - Students can apply their knowledge to their work or vocation in a professional manner and possess the skills which are usually evident through the forming and defending of opinions and resolving problems within their study area.

- CB5 - Students have developed the learning skills necessary to undertake further study in a much more independent manner.

Transversal skills (CT, by the acronym in Spanish):

- CT2 - Independent learning: A range of skills in order to choose research, analysis, evaluation and information management strategies from different sources, as well as to learn and put into practice what has been learnt independently.
- CT3 - Teamwork: Ability to integrate and collaborate actively with other people, areas and/or organisations to reach common goals.
- CT5 - Problem solving: Be able to critically evaluate information, separate complex situations into their constituent parts, recognise patterns, and consider alternatives, different approaches and perspectives in order to find optimal solutions and negotiate efficiently.
- CT7 - Leadership: To be able to direct, motivate and guide others, recognising their skills and abilities in order to effectively manage their development and common interests.

Specific skills (CE, by the acronym in Spanish):

- CE06 - To understand key experimental models and to perform experiments independently, describing, analysing and critically assessing experimental data.
- CE07 - To use the most suitable electronic instruments and IT tools to study physical problems and search for solutions.

Learning outcomes (RA, by the acronym in Spanish):

- RA1. To represent signals in both the time domain and the frequency domain, using the Fourier transform.
- RA2. To use mathematical tools and transformations in the analysis of sampling and the reconstruction of any signal.
- RA3. To process signals or images using the most suitable mathematical tools or software to achieve the desired results.

The following table shows how the skills developed in the subject area match up with the intended learning outcomes:

Skills	Learning outcomes
CG3, CG4, CG5, CT2	RA1. To represent signals in both the time domain and the frequency domain, using the Fourier transform.
CG4, CB2, CT5, CT3, CE06	RA2. To use mathematical tools and transformations in the analysis of sampling and the reconstruction of any signal.
CG2, CB5, CT5, CT7, CE07	RA3. To process signals or images using the most suitable mathematical tools or software to achieve the desired results.

4. CONTENTS

1. Fundamentals of signal processing.
2. Representations of signals and images in the frequency domain.
3. Sampling and signal reconstruction.

4. Image segmentation, characterisation and registration.
5. Image compression and storage.
6. Techniques for analysing, processing and transmitting signals and images.

5. TEACHING/LEARNING METHODS

The types of teaching/learning methods are as follows:

- Case studies: Discussion of real cases that allow for practical application of the acquired theoretical knowledge.
- Collaborative learning: Students learn to collaborate with other people (classmates and professors) in order to find creative, comprehensive and constructive solutions to questions and problems that arise from the given case studies, using all relevant knowledge and material resources available.
- Problem-based learning: Students are given problems and asked to solve them, working individually or in groups.
- Lectures: Presentations by the professor with the necessary technological tools to maximise comprehension of the learning content.
- Workshop-based learning: Students acquire knowledge through learning to use the tools and equipment needed in their profession. In other words, "learning by doing".
- Guided academic activities: Individual and group work that is more independent, including information searches, written summaries, debates and the public defence of projects.

6. LEARNING ACTIVITIES

The types of learning activities, plus the amount of time spent on each activity, are as follows:

On campus:

Learning activity	Number of hours
Lectures	22
Asynchronous lectures	4
Oral presentations of projects and debates	6
Report writing	21
Assessment	6
Practical activities (problems, written work, projects, workshops and/or lab work)	21
Group tutorials	16
Independent working	54
TOTAL	**150**

Online:

Not applicable

7. ASSESSMENT

The assessment systems, plus their weighting in the final grade for the subject area, are as follows:

On campus:

Assessment system	Weighting
Individual on-campus knowledge tests (theory and/or practice)	50%
Oral defence	25%
Submission of group and/or individual reports, written work, projects or exercises	10%
Performance observation	15%

Online:

Not applicable

On the Virtual Campus, when you open the subject area, you'll find details of your assessable tasks, including the submission dates and assessment procedures for each task.