1. OVERVIEW

Subject area	Experimental Project I
Degree	Bachelor's Degree in Physics
School/Faculty	School of Architecture, Engineering and Design
Year	2
ECTS	6
Type	Compulsory
Language(s)	Spanish
Delivery mode	On campus
Semester	2

2. INTRODUCTION

Experimental Project I is one of the four subject areas that make up the subject *Experimental techniques* on the Bachelor's Degree in Physics. This subject, as a whole, is designed to cover all theoretical and practical aspects of experimental physics. Basic experimental data acquisition and processing will have been covered already in the first-year subject area *Core Experimental Techniques*; therefore, in *Experimental Project I*, students will be ready to face bigger and more complex challenges. In the first part of the subject area, students will do lab work associated with the subject areas they have studied or are studying this year: *Mechanics and Waves*, *Thermodynamics* and *Optics*. In the second part of the subject area, they will design and perform their own experiment, following a project-based-learning methodology. They will present and defend the results of their experimental project in public, in front of a panel of professors from this subject area and other areas.

3. SKILLS AND LEARNING OUTCOMES

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

- **CG02** Ability to plan and perform independent work when managing projects associated with different areas of physics.
- **CG04** To convey knowledge, procedures, results and scientific ideas in the field of physics, both orally and in writing.
- **CB04** Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences.
- **CB05** 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):

- **CT01** Ethical values: Ability to think and act in line with universal principles based on the value of individuals, contributing to their development and involving commitment to certain social values.
- **CT02** 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.

- CT03 Teamwork: Ability to integrate and collaborate actively with other people, areas and/or organisations to reach common goals.
- **CT04** Written communication/Oral communication: Ability to communicate and gather information, ideas, opinions and viewpoints in order to understand and be able to act upon them, whether they are through spoken word and gestures, or through written word and/or visual aids.
- **CT05** 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.
- **CT06** Adaptability: Being able to accept, appreciate and integrate different positions, being able to adapt one's own approach as required by the situation, as well as working effectively in ambiguous situations.
- **CT07** 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.
- **CT08** Entrepreneurial spirit: Ability to take on and carry out activities that generate new opportunities, anticipate problems or bring about improvements.

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

- **CE01** To estimate orders of magnitude in order to interpret diverse phenomena.
- **CE04** To understand the laws and principles of physics, to identify their logical and mathematical structure, their experimental basis and the phenomena described through them.
- **CE05** To understand and know how to use the mathematical and numerical methods used in physics and in handling experimental data.
- **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):

- **RA01** To follow measurement-taking protocols, especially when for the safety of the person conducting the experiment.
- **RA02** To effectively manage the systematic and random errors that could affect an experiment.
- **RA03** To understand the role of the measuring instruments, hardware and software used in different areas of physics, with the ability to calibrate and/or configure the corresponding systems.
- **RA04** To understand the codes of ethics applicable to the process of science communication, ensuring the reproducibility and reliability of the data.
- **RA05** To collaborate effectively as part of an experimental group to design and conduct a scientific/technical project.

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

Skills	Learning outcomes
CT02, CE01, CE06, CE07	**RA01** To follow measurement-taking protocols, especially when for the safety of the person conducting the experiment.
CT04, CT05, CE05	**RA02** To effectively manage the systematic and random errors that could affect an experiment.

CE04, CE06, CE07	**RA03** To understand the role of the measuring instruments, hardware and software used in different areas of physics, with the ability to calibrate and/or configure the corresponding systems.
CB04, CT01, CT04	**RA04** To understand the codes of ethics applicable to the process of science communication, ensuring the reproducibility and reliability of the data.
CG02, CG04, CB05, CT03, CT06 CT07, CT08	**RA05** To collaborate effectively as part of an experimental group to design and conduct a scientific/technical project.

4. CONTENTS

1. Mechanics laboratory.
2. Thermodynamics laboratory.
3. Optics laboratory.
4. Integrative project.

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.
- Project-based learning: Geared towards the completion of projects similar to those found in real work environments. This involves following a methodology to complete the project and choosing between different alternatives.
- 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	20

Oral presentations of projects and debates	6
Report writing	40
Assessment	6
Practical activities (problems, written work, projects, workshops and/or lab work)	40
Tutorials	10
Independent working	28
TOTAL	**150**

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) (final test)	15%
Oral defence	15%
Submission of group and/or individual reports, written work or projects	50%
Performance observation	20%

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.

8. BIBLIOGRAPHY

The guidelines for the lab work will be published on the Virtual Campus. These documents contain all the necessary information to perform the experiments, from an introduction to the corresponding theory to details of the experimental procedures. However, for some lab work, it might be useful to refer to the core bibliography for related subjects: *Mechanics and Waves I*, *Optics* and *Thermodynamics*.