1. OVERVIEW

Subject area	Characterisation Techniques
Degree	Bachelor's Degree in Physics
School/Faculty	School of Architecture, Engineering and Design
Year	Third
ECTS	6
Type	Optional
Language(s)	Spanish
Delivery mode	On campus
Semester	S1

2. INTRODUCTION

Characterisation Techniques is an elective subject area that is compulsory for students on the Materials speciality pathway. In this subject area, students will learn about different material characterisation techniques, including spectroscopy and microscopy, diffraction and thermal analysis, the characterisation of physical properties, defects and the simulation of materials.
With this course, students will acquire extensive knowledge of different material analysis and characterisation techniques, understanding the basis of these techniques. In addition, they will receive a basic introduction to using certain equipment and will learn to analyse the results produced by characterisation tools.

3. SKILLS AND LEARNING OUTCOMES

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

- 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.

General skills (CG, by the acronym in Spanish):

- CG2 Ability to plan and perform independent work when managing projects associated with different areas of physics.
- CG3 To understand and express oneself in a language of science other than Spanish in a professional setting.

- 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.

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.
- CE09 To understand the processes for obtaining materials and the physical fundamentals and uses of materials.

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 analysis and 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.

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

- RA1 To identify different material characterisation techniques.
- RA2 To analyse the principles of the tools used to characterise materials.
- RA3 To understand the practical aspects of different material characterisation techniques.
- RA4 To identify different material simulation techniques.

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

Skills	Learning outcomes
CG2, CG3, CG4, CG5	RA1, RA2, RA3, RA4
CB2, CB5	RA1, RA2, RA3, RA4
CE06, CE09	RA1, RA2, RA3, RA4
CT2, CT3, CT5, CT7	RA1, RA2, RA3, RA4

4. CONTENTS

1. Introduction to characterisation techniques
2. Spectroscopy and microscopy
3. Thermal analysis and diffraction techniques
4. Characterisation of physical properties
5. Characterisation of defects
6. Simulation of materials

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

7. ASSESSMENT

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

ASSESSMENT SYSTEMS	Min%	Max. %
Individual on-campus knowledge tests (theory and/or practice)	50%	50%
Oral defence	5%	10%
Submission of group and/or individual reports, written work, projects or exercises	15%	40%
Performance observation	10%	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 reference material for the subject area is as follows:

- D. S. Verma, L. U. Khan, S. Kumar, S. Bahadar, “Handbook of Materials Characterization”, Springer (2018)

The recommended bibliography is indicated below:

- M. Faraldos, C. Goberna, “Técnicas de análisis y caracterización de materiales”, Consejo Superior de Investigaciones Científicas, Ed. CSIC (2011)

- Y. Leng, “Materials Characterization”, Wiley-VCH (2008)

- D. A. Skoog, F. James, S. R. Crouch, “Principios de análisis instrumental”, McGraw-Hill 2008

- J. M. Albellá J.M.; A. M. Cintas, T. Miranda, J. M. Serratosa, “Introducción a la ciencia de los materiales: Técnicas de preparación y caracterización”. Col. Textos Universitarios, vol. 20. Ed. CSIC. (1999)

- D.A. Skoog, J.J. Leary, “Análisis Instrumental”, McGraw-Hill (1996)