1. OVERVIEW

Subject area	Materials Science
Degree	Bachelor's Degree in Industrial Organisation Engineering
School/Faculty	School of Architecture and Polytechnic
Year	Second
ECTS	4.5
Type	Compulsory
Language(s)	Spanish
Delivery Mode	On campus
Semester	2º

2. INTRODUCTION

Materials Science is one of the compulsory subjects in the Degree in Industrial Organisation Engineering syllabus at the Universidad Europea de Valencia. This subject teaches students the core concepts regarding the structure of materials and their properties.

The course is designed to progressively provide students with the required knowledge in this area. We start with an introduction to the properties and possible configurations of bonds between atoms and how these depend on the type of material. Then we move on to crystalline networks and the possible arrangements of atoms in them. After this, we look at the properties of materials on a macroscopic level - the mechanical, optical and thermal properties and how these properties relate to the type of material and its atomic structure. Finally, students also learn the different types of experiments they can do to investigate these properties, as well as industrial uses for the materials depending on the family they belong to and their characteristics. Knowledge gained in this subject serves as a base for understanding the characteristics of the different types of materials studied in other subjects on this degree, such as Mechanical Engineering, Electronic and Electrical Engineering, Production and Manufacturing Systems, and Thermodynamics and Fluid Mechanics.

3. SKILLS AND LEARNING OUTCOMES

Basic 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.
- CB3 - Students have the ability to gather and interpret relevant data (usually within their study area) to form opinions which include reflecting on relevant social, scientific or ethical matters.
- CB4 - Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences.
- CB5 - Students have developed the learning skills necessary to undertake further study in a much more independent manner.

Cross-curricular skills (CT, by the acronym in Spanish):

- CT2 - Independent learning: skills for choosing strategies to search, analyse, evaluate and manage information from different sources, as well as to independently learn and put into practice what has been learnt.
- CT3 - Teamwork: ability to integrate and collaborate actively with other people, areas and/or organisations to reach common goals.
- CT4 - Written/spoken communication: ability to communicate and gather information, ideas, opinions and viewpoints to understand and be able to act, spoken through words or gestures or written through words and/or graphic elements.
- CT5 - Analysis and problem-solving: be able to critically assess information, break down complex situations, identify patterns and consider different alternatives, approaches and perspectives in order to find the
- best solutions and effective negotiations.
- CT8 - Entrepreneurial spirit: ability to take on and carry out activities that generate new opportunities, foresee problems or lead to improvements.

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

- CE06: Ability to use basic knowledge of materials science, associate microstructure synthesis and processing, and use the properties of the materials for solving problems in engineering projects and activity.

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

- RA1: Determine the structure and type of materials required for different engineering projects, taking into account their physical, mechanical and chemical properties together with their structure.

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

Skills	Learning outcomes (RA, by the acronym in Spanish)
CB2, CB3, CB4, CB5, CT2, CT3, CT4, CT5, CT8, CE6	RA1

4. CONTENTS

- The structure of solids.
- Characterisation and basic experiments to determine the properties of materials
- Properties of the families of materials and their industrial uses.

5. TEACHING/LEARNING METHODS

The types of teaching/learning methods are as follows:

• Collaborative learning: students learn to work with other people (colleagues and lecturers) to find creative, comprehensive and constructive solutions to questions and problems that arise from the given case studies, using relevant knowledge and available resources in relation to each subject.
• Problem-based learning: students face problems they must solve either working as a team or independently.
• Master Lecture: presentations by the lecturer using the appropriate technological tools to facilitate understanding of the subject matter.

• Workshop teaching: students acquire knowledge working with the instruments they will use in their future profession. This leads to “learning by doing”.
• Directed academic activities: more independent tasks (individual or in groups), involving search for information, written summaries, debates and public defence of work.

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
Master lectures	19h
Problem-solving and case studies	12h
Practical seminars and debates/discussions	12h
Laboratory work	10h
Field work	2h
Learning contract (definition of interests, needs and objectives)	4h
Autonomous learning	48.5h
Tutorials	5h
Master lectures	19h
TOTAL	**112.5**

7. ASSESSMENT

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

On campus:

Assessment system	Weighting
On Campus tests to evaluate objectives of theory/practical learning (exam-type objective tests, written compositions, oral presentations, case studies/problem solving, debates, simulation tests)	50%
Off-site tests to assess theory/practical learning (case studies/problem-solving)	30%
Attitude assessment tests (attitude assessment rubrics, class participation)	10%
Self- and co-assessment (learning contract, learning objectives)	10%

8. BIBLIOGRAPHY

- James F. Shackelford. “Introducción a la ciencia de materiales para ingenieros”, Pearson- Prentice Hall, 6ª edición (2005).
- William D. Callister, “Introducción a la Ciencia e Ingeniería de los Materiales”, Reverté S.A., (2008)
- William F. Smith, “Fundamentos de la Ciencia e Ingeniería de los Materiales, McGrawHill, 3ª Edición (1999).