COURSE DATA

DATA SUBJECT

Code: 36824
Name: Materials Science I
Cycle: Undergraduate Studies
ECTS Credits: 4.5
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1934 - Double Degree Program in Chemistry-Chemical Engineering	Facultat de Química	3	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1934 - Double Degree Program in Chemistry-Chemical Engineering	Tercer curso	COMPULSORY

COORDINATION

AMOROS DEL TORO PEDRO JOSE

SUMMARY

Materials Science and Equipment Design seeks to set out basic principles and procedures for carrying out the mechanical design of equipment and facilities. Look for foundations to choose the right material for every industrial equipment, depending on the chemicals that come into contact with them and the environment that will support them and working conditions. Also the practical application of basic design principles, the various equipment and systems in industrial chemical plant. In this course, "Materials Science I" deals with the basic principles of structure, binding and reactivity of solids, applied to the study of different types of materials: metals and alloys, ceramics, glasses, polymers, and composites. The subject Materials Science I is a compulsory subject that is taught in the third year of the Double Degree in Chemistry and Chemical Engineering during the first four-month period. In the curriculum of the Universitat de València it consists of a total of 4.5 ECTS credits. The aim of this course is that the students acquire the basic knowledge of Science of Materials for the study, design and/or operation of the most common systems in the chemical industry. The course contents are: Chemistry, synthesis and processing of materials. Structural types and their characteristics. Properties and applications of metallic materials, ceramics, glasses, polymers, and composites. The general objectives of the course are: To make known to the student the structure, binding and reactivity of different types of materials. To familiarize the student with the properties of different types of materials, and the factors influencing them.

• The classes will be taught in the language as stated in the course sheet available on the website of the 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

Knowledge relevant to the subject of General Chemistry I and General Chemistry II.

COMPETENCES / LEARNING OUTCOMES

DESCRIPTION OF CONTENTS

1. INTRODUCTION

Historical perspective. Classification of materials. New materials.

2. CHEMICAL BONDING: EXTENSION AND REVIESION OF BASIC CONCEPTS

Primary and secondary bonds. Bond models. Bond in solids. Basic aspects of band theory.

3. STRUCTURE: EXTENSION AND REVISION OF BASIC CONCEPTS

Levels of structure: atomic, microscopic, macroscopic. Ordered and disordered materials. Bond type-structure type relationship. Electronegativity. Basic aspects of crystallography. Descriptive crystallochemistry. Types of structures. Directions and crystallographic plans. X-ray diffraction.

4. DEFECTS

The importance of defects. The real solid. Thermodynamic aspects. Types of defects. Specific defects. Extended defects. Non-stoichiometric solids. Relationship between defects and properties.

5. DIFFUSION

Diffusion in solids. Laws of diffusion. Factors affecting diffusion. Diffusion mechanisms in solids.

6. METALS AND METAL ALLOYS

Metals, alloys and intermetallic compounds. Introduction to the mechanical properties of metals. Elastic deformation and plastic deformation. Sliding systems. Failure. Fatigue. Hardness: Mechanisms of hardening. Electrical properties. Phase diagrams and development of microstructures. Fe-Carbon system. Steels and castings.

7. CERAMIC MATERIALS AND GLASS

Concept of ceramic material. Ratio of radii. Silicates. Phase diagrams. Mechanical properties of ceramics. Characteristics of the glassy state. Definition of glass. Process of glass formation. Clay products. Manufacturing techniques. Refractories and abrasives.

8. POLYMERIC MATERIALS

Concept of polymer: organic polymers, inorganic polymers. Molecular weight and degree of polymerization. Molecular structure of polymers: linear polymers, branched polymers, crosslinked polymers. Copolymers. Configurations. Crystallinity. Polymerization reactions: Synthesis of polymers. Most important polymers and their applications. Properties of polymers.

9. COMPOSITES

Types of composites. Principle of combined action: Matrix and dispersed phase. Reinforced materials: reinforced with particles and reinforced with fibers. Structural materials. Influence of design. Methods of processing of composites. Calculations in composites.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	7,00
Theory	38,00
Total hours	**45,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	0,00
Independent study and work	32,50
Preparation of lessons	19,00
Preparation for assessment activities	16,00
Resolution of case studies	0,00

Total hours	**67,50**

TEACHING METHODOLOGY

• **Lectures.-** In these classes the professor will give an overview of the topic under study with special emphasis on new aspects or special complexity. Logically, these classes are supplemented by personal study time indicated as non-contact hours. **(G3, G4, R3, R8)**

• **Classes of problems.-** In these classes it will be carried out the specific application of knowledges which students have acquired in the lectures. Students must previously work on the problems to be solved in the class. Solving these problems will be held at times by the teacher and otherwise by the students, either in group or individually. **(G3, G4, R3, R8)**

EVALUATION

• **Option a.-** Continuous assessment through written tests **(G3, G4, R3, R8)**. To pass each test the student must achieve a score of 5 out of 10 or higher. The final result will be the average among them. Average will be performed only if the score of each test is above 4 on 10. The score higher than 5 for each test will be saved during the course. Class attendance **(G3, G4, R3, R8)** and active participation may be viewed positively in the final score **(B1, B2)**.

• **Option b.-** Final exam. It will be applied to students who have not passed the subjects in option a. In this case, the exam score will be limited to a maximum of 8 out of 10 **(G3, G4, R3, R8)**, being able to assess up to 2 points for class attendance and/or active participation **(G3, G4, R3, R8)**.

The subject is considered overcome when the mark obtained is equal to or greater than 5 (over 10).

"In any case, the evaluation system will be governed by what is established in the Evaluation and Qualification Regulations of the Universitat de València for Degrees and Masters

(https://webges.uv.es/uvTaeWeb/MuestraInformacionEdictoPublicoFrontAction.do?accion=inicio&idEdictoSeleccionado=5639)".

Copying or plagiarism of 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).

REFERENCES

- Ciencia e Ingeniería de Materiales. W. D. Callister y D. G. Rethwisch. 2º Edición castellano (9º edición original). Editorial Reverté.
- Introducción a la Ciencia de Materiales para Ingenieros, James F. Shackelford, ed. Pearson, 2005.
- Ciencia e ingenierÍa de los materiales, Donald Askeland y Pradeep P. Phule, Cengage Learning Editores, 2004.
- Química del estado sólido. Una introducción. Smart, L., Moore, E. Addison-Wesley Iberoamericana, Wilmington, 1995.
- Sólidos Inorgánicos. D. M. Adams. Alhambra Universidad, 1986.