VNIVERSITAT DE VALÈNCIA

Course Guide
34758 Materials science II

COURSE DATA

Data Subject	
Code	34758
Name	Materials science II
Cycle	Grade
ECTS Credits	6.0
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
1401 - Degree in Chemical Engineering	School of Engineering	2	Second term

Subject-matter

Degree	Subject-matter	Character
1401 - Degree in Chemical Engineering	11 - Equipment materials and design	Obligatory

Coordination

Name	Department
BADIA VALIENTE, JOSE DAVID	245 - Chemical Engineering
LLOPIS ALONSO, FRANCISCO	245 - Chemical Engineering

SUMMARY

The goal 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 equipment in the chemical industry.

The course contents are: Chemical technology, synthesis and processing of materials. Properties and applications of metallic materials, polymers, ceramics and composites. Corrosion. Behavior and control of materials. Degradation and failure of materials. Inspection and testing. Elasticity and strength of materials.

The subject of Materials Science II is taught in the second degree course in Chemical Engineering during the second quarter. In the curriculum of the Valencia University has a total of 6 ECTS. Included in Materials and Equipment design.

The theory classes will be taught in Spanish and practical classes as stated in the course information 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

Student required some prior knowledge in:
Physics
Chemistry
Mathematics
Materials Science I
Basic level of Castellano.

OUTCOMES

1401 - Degree in Chemical Engineering

- G3 - Knowledge of basic and technological subjects that allows students to learn new methods and theories and provides them with versatility to adapt to new situations.
- G4 - Ability to solve problems with initiative, decision-making skills, creativity and critical reasoning and to communicate and transmit knowledge, abilities and skills in the field of industrial engineering.
- G6 - Ability to deal with specifications, regulations and mandatory standards.
- G8 - Ability to apply the principles and methods of quality control.
- G10 - Ability to work in a multilingual and multidisciplinary environment.
- G11 - Knowledge, understanding and ability to apply the necessary legislation for practising professionally as a qualified industrial technical engineer.
- R3 - Knowledge of materials science, technology and chemistry fundamentals. Understand the relationship between microstructure, synthesis or processing and the properties of materials.
- R8 - Knowledge and use of the fundamentals of the strength of materials.

LEARNING OUTCOMES

Learning results

- Know the properties (chemical, mechanical, thermal and electrical) and industrial applications of different types of materials: ceramic, metal, glass, polymers, and composites and their degradation processes, life and prevention of use. (Outcomes G3, R3)
- Selecting the optimum material for a particular application and justify their choice. (Outcomes G4, G6, R3, R8)
- Determine the mechanical properties of materials and types of tests are used. (Outcomes G4, G6, G8, G11, R3, R8)
- Understanding the mechanisms of corrosion and fracture, and how to avoid them. (Outcomes G4, G6, G8, R3, R8)
- Know and apply regulations and industry codes in the mechanical design of equipment and simple structural elements. (Outcomes G10, G11, R3, R8)
- Know and apply principles of safety in the design of mechanical equipment and structural elements simple. (Outcomes G6, G8, G11, R3, R8)
- Be able to analyze the predictable failures in industrial equipment. (Outcomes G4, G6, R3, R8)
- Prepare written reports. (Outcomes G4, G10, G11)
- Make designs individually and in groups. (Outcomes G6, G8, G11, R3, R8)

After completing the course, students will be able to:

- Know the properties (chemical, mechanical, thermal and electrical) and industrial applications of different types of materials: ceramic, metal, glass, polymers, and composites.
- Determine the mechanical properties of materials and types of tests used.
- Understanding the mechanisms of corrosion and degradation processes and learn methods of prevention.
- Know the types of fracture, and how to avoid them.
- Understand the fundamentals of elasticity and strength of materials and their application in industrial equipment.
- Know the types, fundamentals and functionality of equipment and common elements in the chemical industry.
- Selecting the optimum material for a particular application and justify their choice.
- Select the equipment and / or appropriate item for a particular purpose and justify their choice.
- Know and apply regulations and industry codes in the mechanical design of equipment and simple structural elements.
- Know and apply principles of safety in the design of mechanical equipment and structural elements simple.
- Be able to analyze the predictable failures in industrial.
- Prepare written reports.
- Make designs individually and in groups.

In addition to the specific objectives mentioned above, the course will encourage the development of several social and technical skills, among which include:

- Capacity for analysis and synthesis.
- Ability to argue from rational and logical criteria.
- Ability to communicate in a properly and organized manner.
- Ability to develop a problem in a systematic and organized manner.
- Ability to work and distribute the personal time.
- Ability to work in groups.

DESCRIPTION OF CONTENTS

1. MATERIALS SCIENCE AND ENGINEERING

Materials Science and Engineering. Materials Classification. Materials in Chemical Engineering. New Materials.

2. ELASTICITY AND PLASTICITY OF MATERIALS

Concepts of stress and strain. Elastic deformation. Deformation in shear or torsion. Plastic Deformation. Yield strength. Tensile strength. Ductility. Resilience. Hardness. True stress. Security factors.

3. MECHANICAL RESISTANCE OF MATERIALS

Failure. Fundamentals of Fracture. Ductile or brittle fracture. Fracture toughness. Impact fracture testing. Fatigue. Cyclic stress. Creep. Nondestructive assays. Fractography.

4. PROPERTIES AND APPLICATIONS OF METALLIC MATERIALS

Mechanical properties of metals and alloys, industrial application. Identification Nomenclature. Thermal processing of metal alloys. Dislocations and strengthening mechanism.

5. PROPERTIES AND APPLICATIONS OF CERAMICS.

Mechanical properties of traditional and engineering ceramics. Brittle Fracture. Stress-strain behaviour. Influence of porosity. Glasses. Viscous deformation.

6. PROPERTIES AND APPLICATIONS OF POLYMERS.

Polymer classification. Mechanical Behavior of Polymers. Viscoelasticity. Fracture and Fatigue of Polymers.

7. PROPERTIES AND APPLICATIONS OF COMPOSITES.

Mechanical Characteristics of Composites. Particle reinforced composites. Fiber reinforced composites. Structural composites.

8. INTRODUCTION TO CORROSION AND DEGRADATION OF MATERIALS

Introduction to Corrosion of materials. Economic aspects of corrosion. General mechanisms in the corrosion of metals. Ceramic corrosion. Polymers degradation.

9. BASIS OF METALLIC CORROSION, ELECTROCHEMICAL CONSIDERATIONS

Electrochemical Aspects of Corrosion. Thermodynamic Aspects in the metals corrosion. Corrosion rate. Polarization. Passivity. Galvanic Series. Types of electrochemical corrosion.

10. HIGH TEMPERATURE CORROSION OF METALS

Thermodynamic aspects of hot corrosion. Influence of the physico - chemical properties of the oxide film. Kinetic aspects. Influence of reticular characteristics of oxide film.

11. DEGRADATION AND FAILURE OF MATERIALS

Electrochemical corrosion due to galvanic atmospheric or located factors. Combined action of mechanical and corrosive factors. Corrosion Prevention. Practical considerations in the material selection.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	40,00	100
Classroom practices	20,00	100
Development of individual work	10,00	0
Preparation of evaluation activities	20,00	0
Preparing lectures	30,00	0
Preparation of practical classes and problem	30,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

The development of the course is structured around the theory classes, practical activities and reading research papers, through a scheduled plan that will be given previously to the students. Some of these activities will be evaluated and will contribute to the final mark.

In the theory classes lecture model will be used to explain the most complex or difficult notions and always during periods of less than 30 minutes. Many of the theoretical concepts will be prepared by students working with the material provided to them, always doing an exercise related to the studied material. The main competences worked with these activities will be G3, G4, G6, G10, R3 i R8.

Problems will be developed in practical class sessions following two models. Some problems will be solved by the teacher so that students find out the way to address them, while others will be solved by students, individually or in groups under the supervision of the teacher. After the work, the problems will be collected, analyzed and corrected by the teacher. The main competences worked with these activities will be G3, G6, G8, G10, G11, R3 i R8.

The proposed work for the students will be of several types: Questions or short exercises, problems similar in complexity to those of exams and self-correcting tests performed in the e-learning platform. The main competences worked with these activities will be G3, G4, G6, G10, R3 and R8.

EVALUATION

The evaluation of student learning in the first call will be carried out following two modalities:

Modality A: The evaluation with this modality is based on a continuous evaluation, in which the activities carried out by the students will be assessed (questionnaires and problems delivered) and two objective tests considering two blocks (Block I: topics 1 to 5; Block II: topics 6 to 11). The test of Block I will be carried out at the end of the subject of this block and that of Block II will be on the official date of the first call.

To opt for the evaluation with Mode A, the student must have delivered at least 80% of the scoring activities and have obtained an average grade equal to or greater than 5 (out of 10). Once these two requirements have been passed, the final grade will be obtained as the highest of:

- The weighting between the average mark of the objective tests (70%) and the average mark of the activities (30%), as long as an average mark equal to or greater than 4.5 (out of 10) is obtained in the objective tests.
- The average mark of the objective tests.

In any case, if the average mark of the objective tests is less than 4.5 (out of 10), the final mark will be the average mark of the two objective tests.

Modality B: The evaluation of the subject with this modality will be carried out by means of an examination of all the contents of the subject, which will be done on the official date.

- The mark with this modality will be obtained by weighting between the overall exam mark (85%) and the average mark of the delivered activities (15%), as long as in the final exam an average mark equal to or higher than 4.5 (out of 10).

The course will be considered passed when the grade obtained is equal to or greater than 5 (out of 10). If the student does not obtain a minimum grade of 4.5 (out of 10) in the exam, the final grade will be the one obtained in the exam.

Both the final exam and the objective tests will consist of theoretical-practical questions and problems. The acquisition of G3, G6, G8, G10, G11, R3 and R8 skills will be evaluated.

In the second call, the evaluation will be carried out by Modality B.

REFERENCES

Basic

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Additional

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