

## 30010 - Material Engineering: the Basics

### Syllabus Information

**Academic year:** 2024/25

**Subject:** 30010 - Material Engineering: the Basics

**Faculty / School:** 110 - Escuela de Ingeniería y Arquitectura

**Degree:** 436 - Bachelor's Degree in Industrial Engineering Technology

**ECTS:** 6.0

**Year:** 2

**Semester:** First semester

**Subject type:** Compulsory

**Module:**

### 1. General information

The objective of the subject is to make students aware of the importance that the microstructure of a material has on its final properties and how we can modify it to adjust those properties to a given application. This provides the necessary tools to justify the choice of a material for a given application.

### 2. Learning results

- 1.- To know the fundamentals of the science, technology and chemistry of materials commonly used in Industrial Engineering.
- 2.- Understand the relationship between microstructure, synthesis or processing and material properties.
- 3.- Know how to test materials for characterization of their properties
- 4.- Know how to apply knowledge of science, technology and chemistry to the choice of metallic, ceramic, polymeric and composite materials (decision making ability) and know how to explain their behavior (critical analysis ability).
- 5.- Teamwork, peer teaching and evaluating the work of other peers.

### 3. Syllabus

#### **BLOCK A: STRUCTURE OF MATTER**

- 1.- Crystalline structures
- 2.- Defects and diffusion
- 3.- Phase diagrams and Fe-C phase diagram
- 4.- Phase transformations

#### **BLOCK B: MATERIAL PROPERTIES**

- 5.- Mechanical properties and heat treatments
- 6.- Fracture
- 7.- Fatigue and Creep
- 8.- Thermal properties
- 9.- Electrical properties
- 10.- Magnetic properties
- 11.- Optical properties

#### **BLOCK C: MAIN GROUPS OF MATERIALS**

- 12.- Ferrous and non-ferrous alloys
- 13.- Ceramic materials
- 14.- Polymers
- 15.- Composite materials

### 4. Academic activities

30 h of master class, single group (2 h / week): explanation of the basics of the subject.

15 h of case studies, small group (1 h / week).

12 hours of practice (4 sessions of 3 hours): the student must complete a questionnaire beforehand and make a report

afterwards.

2 h of group work presentation (end of term): choice of certain materials for a given application.

41 h of practical cases resolution.

10 h for the realization of group work.

45 h of individual work (proposed readings, tests, personal study).

4 h of assessment activities

## 5. Assessment system

**Continuous work** throughout the term considered very important, and the following evaluation activities are offered evaluation:

**1-Written test** (50% of the final grade): short questions and problem solving.

**2-Activities related to the laboratory practices** (20% final grade): completion of all practices, their previous questionnaires and corresponding reports.

**3-Activities to be evaluated** throughout the term (30% final grade)

3.1- Quizzes in ADD (5% final grade).

3.2- Problem solving, in class time at the end of each thematic block (15% final grade).

3.3- Group work evaluated by both the teacher and the rest of the students (10% final grade).

A minimum score of 40% in parts 1 and 2 and 50% in part 3 will be required for averaging, and to reach the average grade of 5/10. In case of not reaching 50% in part 3, the weighting of 1 and 2 will be 80% and 20% respectively.

Alternatively, a **single global test** with two parts is available:

**1- Written test** (80% final grade): short questions and problem solving.

**2- Written and practical test** related to the contents worked in practices (20% final grade).

A minimum score of 40% in each of the 2 parts will be necessary to average and reach the average grade of 5/10.

## 6. Sustainable Development Goals

4 - Quality Education

8 - Decent Work and Economic Growth

12 - Responsible Production and Consumption