DIM-SAP-337 Introduction to Materials and their Applications

SEMESTER: Spring

CREDITS: 6 ECTS (4 hours. per week).

LANGUAGE: English.

DEGREES: SAPIENS program

Course overview:

The course introduces the student to the following topics: structure of materials and defects in solids; diffusion processes in solid state; chemical composition and phase transformations; mechanical properties of metals; properties and applications of metal alloys, ceramics, polymers, composites and biomaterials: and mechanisms of degradation of materials. Methodologies for material selection in engineering applications is also emphasized. In addition to lectures, students will carry out lab activities and practical sessions to solve real problems, which will be fundamental and mandatory to a better understanding of the concepts covered in the lectures.

Prerequisites:

A basic knowledge of introductory engineering design and calculus is needed and, in particular, basic knowledge of chemistry, chemical bonding and crystalline systems.

Course contents:

Theory:

1. **Overview of materials.**
2. **Defects in solids and diffusion.**
3. **Phase diagrams.**
4. **Mechanical properties.**
5. **Metal alloys.**
6. **Ceramics.**
7. **Polymers.**
8. **Composites and biomaterials.**
9. **Degradation of materials.**
10. **Other properties.**

Laboratory:

In addition to lectures, students will carry out 6 lab sessions, related to the theoretical concepts seen in class. Each session will be 2-hours-long. The students will be divided into groups of 3-4 people, and each group must deliver a report about the concepts reviewed during each session, at the end of each activity. These activities will lead to a better understanding of theoretical concepts.

1. **Mechanical properties.**
2. **Grain size determination.**
3. **Phase diagrams and metallography.**
4. **Materials selection.**
5. **Polymeric materials.**
6. **Composite materials.**

Methodology

1. **Expository lessons:**

The teacher will explain the concepts through presentations and the resolution of practical exercises. The PDF versions of the theoretical presentations, corresponding to every unit, as well as the list of exercises will be accessible for students through the Moodlerooms platform.

2. **Lab sessions:**

Students will carry out 6 lab sessions, related to the theoretical concepts seen in class. Each session will be 2-hours-long. The students will be divided into groups of 3-4 people. Once the activity is concluded, each group must deliver a report about the main concepts reviewed during each session, according to their protocols.

3. **Tutorials:**

In order to clarify any aspect of the subject, students will be able to request individual tutorials (with no more than 3 people at the same time), both to the lab and theory teachers, upon previous requests to them by mail.

4. **Visits:**

In addition to lectures and lab activities, but only if the university's agenda, the classes planning, and the availability of the centers allow it, the teachers will organize 1 or 2 visits to Spanish centers specialized in materials science.

Grading

Ordinary examination:

The score for the ordinary final mark will be obtained by:

50% written examination,

30% follow-up examinations,

20% lab sessions (≥ 5.0).

* The lack of attendance at some of the activities means a 0 at that session.

* A delay in the delivery of reports means a minimum penalty of 2 points.

Extraordinary examination:

The score for the extraordinary final mark will be obtained by:

80% written examination (≥ 5.0),

20% lab sessions.

Textbook:

Callister, W.D. (2014) Materials Science and Engineering: An Introduction. 9th Edition, John Wiley & Sons, New York.

Dowling, N.E. (2013) Mechanical behavior of materials: engineering methods for deformation, fracture and fatigue 4th Edition, Pearson Education, London.

Groover, M.P. (2010) Fundamentals of Modern Manufacturing Materials Processes and Systems 4th Edition, John Wiley & Sons, New York

Use of AI:

The use of AI to create entire works or relevant parts, without citing the source or the tool, or without explicit permission in the assignment description, will be considered plagiarism and will be regulated in accordance with the University General Regulations.