ESCUELA TÉCNICA SUPERIOR
DE INGENIERÍA

DIM-SAP-337 Introduction to Materials and their Applications

SEMESTER: Spring

CREDITS: 6 ECTS (4 hrs. per week)

LANGUAGE: English

DEGREES: SAPIENS program

Course overview

The course introduces the student to the following topics: Structure of materials, chemical composition, phase transformations, corrosion and mechanical properties of metals, the failure of materials, ceramics, polymers and related materials. Methodologies for material selection in engineering applications is also emphasized. In addition to lectures the students will attend one fifty minute demonstration/recitation session per week. These sessions are required are intended to demonstrate the concepts covered in the lectures.

Prerequisites

A basic knowledge of introductory engineering design and calculus is needed.

Course contents

Theory:

1. Overview of Materials: Atomic Structure, Types of Bonding

2. Crystal Structure

3. Defects in Solids, Diffusion

4. Mechanical Properties and Strengthening Mechanisms

5. Failure, Phase Diagrams and Equilibrium

6. Kinetics, Phase Transformations and Microstructure

7. Corrosion

8. Ceramics, Processing and Applications

9. Polymers: Structure, Processing and Applications

10. Composites

11. Electrical properties

12. Semiconductors & Growth

13. Optical Properties

14. Magnetic Properties & Recording Media and Thermal Properties

15. Biomaterials

Laboratory:

In addition to lectures the students will attend to seven 2 hours laboratory sessions per semester. These sessions are required to demonstrate the concepts covered in the lectures.

P1. Mechanical properties.

P2. Grain size determination.

P3. Phase diagrams and metallography.

P4. Materials selection.

P5. Polymer materials.

P6. Composite materials

Textbook

- Callister, William D. Jr., Fundamentals of Materials Science and Engineering: An Integrated Approach 3rd Ed., John Wiley and Sons, 2008 ISBN 9780470125373

Grading

To pass the course is necessary to achieve an overall grade of at least 5 over 10. The overall grade is obtained as follows:

- Final exam: 50%
- Midterm exams: 30%
- Laboratory: 20%.