

Centre	University College of Engineering of Vitoria-Gasteiz
Name of subject	25983 – Materials Science
Qualification	Degree in Mechanical Engineering
Type	Compulsory
Credits	6 ECTS
Year	2
Term(s)	1st
Department	Mining and Metallurgical Engineering and Materials Science
Language	Spanish and Basque

Outcomes / Objectives

1. Use subject specific terminology correctly, expressing the basic principles of Materials Science through the correct use of verbal, mathematical and graphic language.
2. Distinguish the main types of materials and be able to match their different characteristics to their various applications.
3. Match the internal structure of materials to their specific physicochemical and mechanical properties, determining the impact of these properties on the practical function of each material.
4. Handle the concept of equilibrium state of a material and be able to reason how a mechanical or heat treatment can change that state, and hence, the properties of the material.
5. Work cooperatively to complete tasks in the field of Materials Science, carrying out team tasks and analysing and discussing ideas contributed by other members of the team.

Syllabus

1. Structure of condensed matter. Crystalline and amorphous structure. Groups of materials. Crystal lattice defects. Diffusion phenomena.
2. Solidification. Solidification mechanisms. Phase diagrams.
3. Manufacture of materials. Obtaining and transformation of metallic, polymeric, ceramic and composite materials. Natural resources, synthesis, recycling.
4. Properties of materials. Mechanical, electrical and magnetic properties of materials and their relation to structure. Materials testing. Other physical and chemical properties.
5. Modification of the structure of materials. Heat, thermochemical and thermomechanical treatment. Effect on the properties of materials.
6. Engineering materials. Metallic, polymeric, ceramic and composite materials. Properties, classification and applications. New materials for new applications.
7. Service conditions and fault diagnosis. Corrosion, fatigue, creep, wear and ageing conditions. Fault analysis.
8. Selection of materials. Material selection criteria: service requirements and economic criteria.

Methodology

Teaching Method

Face-to-Face Teaching Hours

Lectures	Seminars	Classroom practice	Lab. practice	Computer sessions	Clinical practice	Workshops	Industrial workshops	Field practice
48			12					

Student Hours of Non Face-To-Face Activities

Lectures	Seminars	Classroom practice	Lab. practice	Computer sessions	Clinical practice	Workshops	Industrial workshops	Field practice
72			18					

Assessment System

General criteria

Written essay exam

Practical activities (exercises, case studies or problems)

Group assignments

Clarification regarding assessment

Overall subject grade = (0.2) x Laboratory exam grade + (0.8) x Theoretical exam grade

Bibliography

Basic Bibliography

Fundamentos de la Ciencia e Ingeniería de los Materiales. W.F. Smith (McGraw-Hill)

Introducción e Ingeniería de los Materiales. W.D. Callister Jr. (Reverté)

Ciencia de Materiales. Teoría - Ensayos - Tratamientos. P. Coca Rebolero, J. Rosique Jiménez (Ediciones Pirámide S.A.)

Subject notes.

In-depth Bibliography

Materiales para Ingeniería. M.F. Ashby, D.R.H. Jones (Reverté)

Metales y Aleaciones: su constitución, estructura, propiedades y tratamientos. R. Calvo Rodas (INTA)

Introducción a la metalurgia Física. S.H Avner, McGraw-Hill, Mexico, 1988

Ciencia e ingeniería de materiales : metalurgia física, estructura y propiedades. J.A. Pero Sanz, Cie Dossat 2000, Madrid, 2004

Journals:

Metalurgia y Electricidad

Fundidores

Plásticos universales

Journal of Materials Science

Materials Science and Engineering

Websites

➤ MATTER - Materials Science & Engineering Educational Software

➤ <http://www.matter.org.uk>

➤ MatWeb - Online Materials Information Resource

➤ <http://www.matweb.com>

➤ ASM Handbook

➤ <http://products.asminternational.org/hbk/index.jsp>