

Academic Year: ( 2023 / 2024 )

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Department assigned to the subject: Materials Science and Engineering and Chemical Engineering Department

Coordinating teacher: VELASCO LOPEZ, FRANCISCO JAVIER

Type: Electives ECTS Credits : 6.0

Year : 4 Semester :

## REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Materials Science and Engineering

## LEARNING OUTCOMES

CB1. Students have demonstrated possession and understanding of knowledge in an area of study that builds on the foundation of general secondary education, and is usually at a level that, while relying on advanced textbooks, also includes some aspects that involve knowledge from the cutting edge of their field of study

CB2. Students are able to apply their knowledge to their work or vocation in a professional manner and possess the competences usually demonstrated through the development and defence of arguments and problem solving within their field of study.

CB3. Students have the ability to gather and interpret relevant data (usually within their field of study) in order to make judgements which include reflection on relevant social, scientific or ethical issues.

CB5. Students will have developed the learning skills necessary to undertake further study with a high degree of autonomy.

CG1. Ability to solve problems with initiative, decision-making, creativity, critical reasoning and to communicate and transmit knowledge, skills and abilities in the field of Industrial Engineering.

CG3. Ability to design a system, component or process in the field of Industrial Technologies to meet the required specifications

CG4. Knowledge and ability to apply current legislation as well as the specifications, regulations and mandatory standards in the field of Industrial Engineering.

CG5. Adequate knowledge of the concept of company, institutional and legal framework of the company. Organisation and management of companies.

CG6. Applied knowledge of company organisation.

CG8. Knowledge and ability to apply quality principles and methods.

CG9. Knowledge and ability to apply computational and experimental tools for the analysis and quantification of Industrial Engineering problems.

RA1. Knowledge and understanding: Have basic knowledge and understanding of science, mathematics and engineering within the industrial field, as well as knowledge and understanding of Mechanics, Solid and Structural Mechanics, Thermal Engineering, Fluid Mechanics, Production Systems, Electronics and Automation, Industrial Organisation and Electrical Engineering.

RA2. Engineering Analysis: To be able to identify engineering problems within the industrial field, recognise specifications, establish different resolution methods and select the most appropriate one for their solution

RA4. Research and Innovation: To be able to use appropriate methods to carry out research and make innovative contributions in the field of Industrial Engineering.

RA5. Engineering Applications: To be able to apply their knowledge and understanding to solve problems and design devices or processes in the field of industrial engineering in accordance with criteria of cost, quality, safety, efficiency and respect for the environment.

## OBJECTIVES

- Ability to solve problems with initiative, decision making, creativity, critical reasoning and to communicate and transmit knowledge, abilities and skills in the field of the selection of materials in Industrial Engineering.
- Ability to design a system, component or process from the point of view of the selection of materials in

the field of Industrial Technologies, to meet the required specifications.

- Knowledge and ability to apply current legislation as well as the specifications, regulations and mandatory standards for materials selection processes in the field of Industrial Engineering.
- Knowledge and ability to apply the principles and methods of quality required in the material selection processes.
- Knowledge and ability to apply computational and experimental tools for the analysis and quantification of Industrial Engineering problems in the field of material selection.
- To develop abilities to work in groups and distribute work to face up to complex problems.
- To extrapolate materials selection procedures to other engineering problems.
- To communicate (oral and written) concepts, developments and results related to materials selection.

Overcoming this subject guarantees the student has learn to:

- Be able to establish procedures of materials selection.
- Be able to evaluate reasons to select and use materials in individual applications.
- Understand how selection procedure affects selection of materials.

## DESCRIPTION OF CONTENTS: PROGRAMME

1. Materials selection
  - 1.1. Introduction
  - 1.2. Process of design and materials selection
  - 1.3. Methods of materials selection.
  - 1.4. Design and selection for mechanical properties
  - 1.5. Design and selection for functional properties
  - 1.6. Environmental aspects of materials selection
  - 1.7. Methods of manufacturing process selection
  - 1.8. Rapid prototyping and additive manufacturing
2. Materials for different industries
  - 2.1. Automotive industry
  - 2.2. High-technology processes for automotive industry
  - 2.3. Aeronautics industry
  - 2.4. Aerospace industry
3. Materials with technological interest and their applications.
  - 3.1. Metallic foams
  - 3.2. Intermetallics
  - 3.3. Carbon-based materials
  - 3.4. Nanomaterials
  - 3.5. Phase change materials

## LEARNING ACTIVITIES AND METHODOLOGY

- Teaching classes.
- Class exercises. Individual exercises.
- Lab practices to use materials selection software programmes.
- Work in groups.

## ASSESSMENT SYSTEM

<b>% end-of-term-examination/test:</b>	0
<b>% of continuous assessment (assignments, laboratory, practicals...):</b>	100

- Lab practices: 15%
- Class exercises: 50%
- Public exhibition: 15%
- Assessment tests: 20%

## BASIC BIBLIOGRAPHY

- ASHBY, M.F. Materials selection in mechanical design, Butterworth-Heinemann, 1999
- BUDINSKI, K.G. Engineering materials: Properties and selection, Prentice-Hall International, 1996

- CHARLES, J.A.; CRANE, F.A.A.; FURNESS, J.A.G. Selection and use of engineering materials, Butterworth Heinemann, 1997

- SWIFT, K.G.; BOOKER, J.D. Process selection: from design to manufacture, Butterworth-Heinemann, 2003

#### ADDITIONAL BIBLIOGRAPHY

- AGUEDA, E. y otros Fundamentos tecnológicos del automóvil, Paraninfo.

- ASHBY, M.F.; JONES, D.R.H. Engineering Materials I: An introduction to their properties and applications, Pergamon Press, 1980

- HAPPIAN-SMITH, J. An introduction to modern vehicle desing, Butterworth Heinemann, 2002

- NOORANI, R. Rapid prototyping: principles and applications, John Wiley & Sons, 2006