UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course: MATERIALS SCIENCE
Code: 56313
Type: CORE COURSE
ECTS credits: 6
Degree: 359 - UNDERGRAD. IN INDUSTRIAL ELECTRONICS AND AUTOMAT. ENGINEERING (CR)
Academic year: 2021-22
Center: 602 - E.T.S. INDUSTRIAL ENGINEERING OF C. REAL
Group(s): 20 21
Year: 2
Duration: First semester
Main language: Spanish
Second language: English
Use of additional languages:
English Friendly: Y
Web site:
Bilingual: N

Lecturer: **GEMA HERRANZ SANCHEZ-COSGALLA** - Group(s): **21**

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Lecturer: **GLORIA PATRICIA RODRIGUEZ DONOSO** - Group(s): **20**

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Lecturer: **ANA ROMERO GUTIERREZ** - Group(s): **20**

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2. Pre-Requisites

It is advisable to have knowledge of mathematics, physics and chemistry acquired in the preceding course (1st year)

3. Justification in the curriculum, relation to other subjects and to the profession

Material Science is a mandatory subject in Mechanical Engineering, Electrical Engineering and Industrial Electronic and Automatic Engineering Degrees.

The concepts developed in this subject will be used later in a mandatory subject “Engineering and Technology of materials” (Mechanical Eng.) and in elective subjects such as “Advanced Materials” (Mechanical Eng.), “Electrical and Magnetic Materials” (Electrical Eng. and Industrial Electronic and Automatic Eng.)

4. Degree competences achieved in this course

Course competences

Code	Description
A02	To know how to apply knowledge to work or vocation in a professional manner and possess the competences that are usually demonstrated by the formulation and defence of arguments and the resolution of problems in the field of study.
A03	To have the capability to gather and interpret relevant data (normally within the area of study) to make judgements that include a reflection on themes of a social, scientific or ethical nature.
A04	To be able to transmit information, ideas, problems and solutions to a specialized audience.
A05	To have developed the learning skills necessary to undertake subsequent studies with a greater degree of autonomy.
A06	Command of a second foreign language at B1 level of the Common European Framework of Reference for Languages.
A08	Appropriate level of oral and written communication.
A12	Knowledge of basic materials and technologies that assist the learning of new methods and theories and enable versatility to adapt to new situations.
A13	Ability to take the initiative to solve problems, take decisions, creativity, critical reasoning and ability to communicate and transmit knowledge, skills and abilities in Industrial Electronic Engineering and Automation.
A14	Knowledge to undertake measurements, calculations, evaluations, appraisals, studies, give expert opinions, reports, work plans and similar tasks.
A15	Ability to work to specifications and comply with obligatory rules and regulations.
C03	Knowledge of the fundamentals of science, technology and chemistry of materials. Understanding of the relation between the microstructure, synthesis, processing and properties of materials.
CB01	Prove that they have acquired and understood knowledge in a subject area that derives from general secondary education and is appropriate to a level based on advanced course books, and includes updated and cutting-edge aspects of their field of knowledge.
CB02	Apply their knowledge to their job or vocation in a professional manner and show that they have the competences to construct and justify arguments and solve problems within their subject area.
	Be able to gather and process relevant information (usually within their subject area) to give opinions, including reflections on relevant

CB03	social, scientific or ethical issues.
CB04	Transmit information, ideas, problems and solutions for both specialist and non-specialist audiences.
CB05	Have developed the necessary learning abilities to carry on studying autonomously

5. Objectives or Learning Outcomes

Course learning outcomes

Description

Recognize metal alloys, polymers, ceramics and compounds most commonly used in the industry and their applicability.

Understand and know how to select the most appropriate strengthening mechanism

Understand the structure of materials and the causes of their behaviour related to their microstructure and their equilibrium diagrams

Understand the relation between the microstructure of the material and its macroscopic properties (mechanical, optical, electrical, magnetic and chemical).

Differentiate the different mechanical properties of materials, knowing how to approach mechanical tests

Introduce the student to science and materials engineering

6. Units / Contents

Unit 1: Introduction to Materials Science and Engineering

Unit 2: Crystal Structures, Imperfections, and Diffusion in Solids

- **Unit 2.1** Crystal Structures
- **Unit 2.2** Crystalline Imperfections
- **Unit 2.3** Atomic diffusion in solids

Unit 3: Microstructure and Phase Transformations

- **Unit 3.1** Binary Phase diagrams
- **Unit 3.2** Invariant Reactions
- **Unit 3.3** Ternary Phase Diagrams
- **Unit 3.4** Steel Phase Diagram

Unit 4: Mechanical properties

- **Unit 4.1** Mechanical behaviour and testing of materials
- **Unit 4.2** Strengthening Mechanisms

Unit 5: Electrical, Magnetic, Thermal and Optical Properties of Materials

- **Unit 5.1** Electrical and Magnetic properties
- **Unit 5.2** Thermal and Optical Properties

Unit 6: Engineering materials

- **Unit 6.1** Metallic Materials
- **Unit 6.2** Polymeric Materials
- **Unit 6.3** Ceramic Materials
- **Unit 6.4** Composite Materials

7. Activities, Units/Modules and Methodology

Training Activity	Methodology	Related Competences (only degrees before RD 822/2021)	ECTS	Hours	As	Com	Description
Class Attendance (theory) [ON-SITE]	Lectures	A01 A05 A12 A14 A15 C03	0.8	20	N	-	
Laboratory practice or sessions [ON-SITE]	Group Work	A02 A03 A08 A14 A15 C03	0.32	8	Y	Y	
Problem solving and/or case studies [ON-SITE]	Problem solving and exercises	A01 A02 A03 A04 A13 A14 C03	0.8	20	Y	Y	
On-line Activities [OFF-SITE]	Combination of methods	A01 A02 A12 A13 A14 C03	0.4	10	N	-	
Study and Exam Preparation [OFF-SITE]	Self-study	A01 A02 A03 A05 A12 A13 A14 A15 C03	3	75	N	-	
Practicum and practical activities report writing or preparation [OFF-SITE]	Self-study	A02 A03 A08 A14 A15 C03	0.2	5	Y	Y	
Individual tutoring sessions [ON-SITE]	Combination of methods	A01 A02 A08	0.32	8	N	-	
Final test [ON-SITE]	Assessment tests	A01 A02 A03 A04 A05 A08 A12 A13 A14 A15 C03	0.16	4	Y	Y	
		Total:	**6**	**150**			
		Total credits of in-class work: 2.4					**Total class time hours: 60**
		Total credits of out of class work: 3.6					**Total hours of out of class work: 90**

As: Assessable training activity

Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

8. Evaluation criteria and Grading System

Evaluation System	Continuous assessment	Non-continuous evaluation*	Description
Assessment of problem solving and/or case studies	18.00%	18.00%	Using the Moodle platform, the instructor will conduct individual tests about course contents. No Recoverable.

~~Laboratory sessions~~	~~15.00%~~	~~15.00%~~	~~Compulsory to pass the subject.~~
Final test	67.00%	67.00%	The final exam may include problems and questions about theoretical concepts. Minimum grade to pass the subject: 5 points out of 10.
Total:	**100.00%**	**100.00%**	

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject , an ordinary and an extraordinary one (evaluating 100% of the competences).

Evaluation criteria for the final exam:

Continuous assessment:

To pass the course it is compulsory to have a minimum score of 5 out of 10 in the final exam.

Non-continuous evaluation:

Evaluation criteria not defined

Specifications for the resit/retake exam:

To pass the course it is compulsory to have a minimum score of 5 out of 10 in the final exam.

Specifications for the second resit / retake exam:

To pass the course it is compulsory to have a minimum score of 5 out of 10 in the final exam.

9. Assignments, course calendar and important dates

Not related to the syllabus/contents	
Hours	**hours**
Individual tutoring sessions [PRESENCIAL][Combination of methods]	8
Final test [PRESENCIAL][Assessment tests]	4
Unit 1 (de 6): Introduction to Materials Science and Engineering	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	1
Unit 2 (de 6): Crystal Structures, Imperfections, and Diffusion in Solids	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Laboratory practice or sessions [PRESENCIAL][Group Work]	1
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	4
On-line Activities [AUTÓNOMA][Combination of methods]	2
Study and Exam Preparation [AUTÓNOMA][Self-study]	7
Unit 3 (de 6): Microstructure and Phase Transformations	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	4
Laboratory practice or sessions [PRESENCIAL][Group Work]	3
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	5
On-line Activities [AUTÓNOMA][Combination of methods]	2
Study and Exam Preparation [AUTÓNOMA][Self-study]	14
Practicum and practical activities report writing or preparation [AUTÓNOMA][Self-study]	2.5
Unit 4 (de 6): Mechanical properties	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	4
Laboratory practice or sessions [PRESENCIAL][Group Work]	4
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	6
On-line Activities [AUTÓNOMA][Combination of methods]	3
Study and Exam Preparation [AUTÓNOMA][Self-study]	21
Practicum and practical activities report writing or preparation [AUTÓNOMA][Self-study]	2.5
Unit 5 (de 6): Electrical, Magnetic, Thermal and Optical Properties of Materials	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Study and Exam Preparation [AUTÓNOMA][Self-study]	5
Unit 6 (de 6): Engineering materials	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	7
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	5
On-line Activities [AUTÓNOMA][Combination of methods]	3
Study and Exam Preparation [AUTÓNOMA][Self-study]	28
Global activity	
Activities	**hours**
Laboratory practice or sessions [PRESENCIAL][Group Work]	8
Class Attendance (theory) [PRESENCIAL][Lectures]	20
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	20
On-line Activities [AUTÓNOMA][Combination of methods]	10
Study and Exam Preparation [AUTÓNOMA][Self-study]	75
Practicum and practical activities report writing or preparation [AUTÓNOMA][Self-study]	5
Individual tutoring sessions [PRESENCIAL][Combination of methods]	8
Final test [PRESENCIAL][Assessment tests]	4
Total horas:	150

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Universidad de Liverpool	Programa MATTER, Materials Teaching Educational Resources http://www.matter.org.uk/default.htm				2012	
Askeland, Donald R.	Ciencia e ingeniería de los materiales	Paraninfo		84-9732-016-6	2001	
Askeland, Donald R.	The science and engineering of materials	Thomson		0-495-24442-2	2006	
Callister, William D., (jr.)	Fundamentals of materials science and engineering : an integ	John Wiley & Sons		978-0-470-23463-1	2008	
Callister, William D., (jr.)	Introducción a la ciencia e ingeniería de los materiales	Reverté		978-84-291-7252-2	2009	
G.Herranz, G. P. Rodríguez	Apuntes de la asignatura				2020	Presentaciones utilizadas en clase y listado de ejercicios propuestos
Juan Manuel Montes Martos, Francisco Gómez Cuevas y Jesús Cintas Físico	Ciencia e ingeniería de los materiales	Paraninfo		979-84-283-3017-6	2014	
Massachusetts Institute of Technology	MIT OpenCourseWare http://ocw.mit.edu/courses/materials-science-and-engineering				2012	
Shackelford, James F.	Introducción a la ciencia de materiales para ingenieros	Pearson Prentice Hall		978-84-8322-659-9	2010	
Smith, William F.	Foundations of materials science and engineering	McGraw-Hill		0-07-296304-2	2006	
Smith, William F.	Fundamentos de la ciencia e ingeniería de materiales	McGraw-Hill		0-07-296304-2 (CD-RO	2006	
Smith, William F.	Fundamentos de la ciencia e ingeniería de materiales	McGraw-Hill		970-10-5638-8	2006	