

**1. General information****Course:** MATERIALS IN CHEMICAL ENGINEERING**Type:** CORE COURSE**Degree:** 344 - CHEMICAL ENGINEERING**Center:** 1 - FACULTY OF SCIENCE AND CHEMICAL TECHNOLOGY**Year:** 3**Main language:** Spanish**Use of additional languages:****Web site:****Code:** 57721**ECTS credits:** 6**Academic year:** 2023-24**Group(s):** 21**Duration:** First semester**Second language:** English**English Friendly:** Y**Bilingual:** N**Lecturer:** ANA SANCHEZ-MIGALLON BERMEJO - Group(s): 21

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Edificio San Alberto Magno	QUÍMICA INORG., ORG., Y BIOQ.	+34926051941	ana.smigallon@uclm.es	Monday-Wednesday from 12:00 to 14:00

**Lecturer:** ELENA VILLASEÑOR CAMACHO - Group(s): 21

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**2. Pre-Requisites**

It is recommended that the student has done courses fundamentals of chemistry, organic chemistry, and inorganic chemistry allowing to know the nomenclature of inorganic and organic compounds, according to IUPAC rules, as well as quantities and units physico-chemical

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

Chemical engineering degree student must acquire the conceptual and technical tools that enable you to exercise in the field of science and engineering of materials. It's a subject common to the industrial branch, so it is taught in the third year of the degree, in the first half, and on the other hand is a compulsory subject since since the beginning of civilization, along with the energy materials are used to improve the niv of life of mankind. All of the products that surround us are made based on materials, each time with better properties. This course will study the types of materials used in chemical engineering, expressing the current competition between materials and the future trends in their use.

**4. Degree competences achieved in this course****Course competences**

Code	Description
E09	Knowledge of the fundamentals of science, technology and materials chemistry. To understand the relationship between the microstructure, the synthesis or processing and the properties of the materials.
E14	Knowledge and use of the principles of the resistance of materials.
G03	Knowledge in basic and technological subjects, which enables them to learn new methods and theories, and give them versatility to adapt to new situations.
G14	Proper oral and written communication
G18	Synthesis capacity
G20	Ability to analyze and solve problems
G21	Ability to learn and work autonomously
G22	Ability to apply theoretical knowledge to practice

**5. Objectives or Learning Outcomes****Course learning outcomes****Description**

To know fundamental aspects of crystalline matter for the understanding of the properties and behavior of metals and alloys and any material that may have a crystalline structure.

To know the processing, properties and applications of ceramic materials.

To know the processing, properties and applications of polymeric and composite materials.

To know the main industrial tests used to evaluate the mechanical properties of metals and alloys as well as for quality control.

To know the different types of metal alloys, especially steel, its processing, properties and applications.

To know the electrical properties of metals and alloys. Study of superconductors

To know the structure, preparation, properties and applications of zeolites.

To have skills for the autonomous search of information, analysis, interpretation and use for practical purposes.

**Additional outcomes****6. Units / Contents**

- Unit 1: Materials and engineering
- Unit 2: Inorganic solids
- Unit 3: Crystal defects and non-stoichiometry
- Unit 4: Mechanical properties of metals
- Unit 5: Alloys
- Unit 6: Electric properties of metals
- Unit 7: Polymeric materials
- Unit 8: Ceramic materials
- Unit 9: Composites
- Unit 10: Zeolites
- Unit 11: Introduction to nanomaterials

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	E09 E14 G03 G14	1.5	37.5	N	-	
Problem solving and/or case studies [ON-SITE]	Project/Problem Based Learning (PBL)	G03 G20	0.5	12.5	Y	N	
Group tutoring sessions [ON-SITE]	Group tutoring sessions	G14 G18 G20	0.2	5	Y	N	
Other off-site activity [OFF-SITE]	Self-study	G21 G22	3.6	90	N	-	
Other on-site activities [ON-SITE]	Assessment tests	E14 G18 G20 G22	0.2	5	Y	N	
<b>Total:</b>			<b>6</b>	<b>150</b>			
<b>Total credits of in-class work: 2.4</b>			<b>Total class time hours: 60</b>				
<b>Total credits of out of class work: 3.6</b>			<b>Total hours of out of class work: 90</b>				

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 active participation	10.00%	0.00%	Class participation will be positively valued
Assessment of problem solving and/or case studies	20.00%	0.00%	The evaluation seminars carried out in class will be positively valued.
Final test	70.00%	100.00%	
<b>Total:</b>	<b>100.00%</b>	<b>100.00%</b>	

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:

It will be calculated based on the following: 70% theoretical exam plus (10+20)% evaluable continuous evaluation tests.

The final grade will be obtained considering the distribution of credits of the areas that teach the subject, i.e. 25% polymeric materials and 75% of the rest of the subjects.

##### Non-continuous evaluation:

The student who does not follow the continuous evaluation must communicate it to the teaching staff at the beginning of the course, that is to say, in the first days of the course and in writing.

#### Specifications for the resit/retake exam:

The criteria indicated in the continuous or non-continuous evaluation will be applied depending on the student's choice at the beginning of the course.

#### Specifications for the second resit / retake exam:

In the special call for the end of the course, the student will have to take the exam of the whole course, regardless of having passed any of the continuous evaluation tests.

9. Assignments, course calendar and important dates	
Not related to the syllabus/contents	
Hours	hours
<b>Unit 1 (de 11): Materials and engineering</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	1
<b>Unit 2 (de 11): Inorganic solids</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	4
Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	3
Group tutoring sessions [PRESENCIAL][Group tutoring sessions]	1
<b>Unit 3 (de 11): Crystal defects and non-stoichiometry</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	2

<b>Unit 4 (de 11): Mechanical properties of metals</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	4
Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	2
Group tutoring sessions [PRESENCIAL][Group tutoring sessions]	1
<b>Unit 5 (de 11): Alloys</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	4
Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	3
Group tutoring sessions [PRESENCIAL][Group tutoring sessions]	1
<b>Unit 6 (de 11): Electric properties of metals</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	1
<b>Unit 7 (de 11): Polymeric materials</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	12
Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	3
Group tutoring sessions [PRESENCIAL][Group tutoring sessions]	1
<b>Unit 8 (de 11): Ceramic materials</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	2
<b>Unit 9 (de 11): Composites</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	2
<b>Unit 10 (de 11): Zeolites</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	1
Group tutoring sessions [PRESENCIAL][Group tutoring sessions]	1
<b>Unit 11 (de 11): Introduction to nanomaterials</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	1
Other on-site activities [PRESENCIAL][Assessment tests]	5
<b>Global activity</b>	
<b>Activities</b>	<b>hours</b>
Other on-site activities [PRESENCIAL][Assessment tests]	5
Class Attendance (theory) [PRESENCIAL][Lectures]	36
Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)]	13
Group tutoring sessions [PRESENCIAL][Group tutoring sessions]	5
<b>Total horas: 59</b>	

<b>10. Bibliography and Sources</b>						
<b>Author(s)</b>	<b>Title/Link</b>	<b>Publishing house</b>	<b>Citv</b>	<b>ISBN</b>	<b>Year</b>	<b>Description</b>
A.K.Cheetham, P. Day	Solid state chemistry compounds	Clarendon Press Oxford			1992	
A.K.Cheetham, P. Day	Solid state chemistry techniques	Oxford Science Publications			1991	
C.E.Arraher, Jr	Introduction to polymer chemistry	CRC Press		978-1-4398-0953-2	2010	
D. Hull	An introduction to composite materials	Cambridge University Press			1993	
D. R. Askeland	La Ciencia e Ingeniería de Materiales	Paraninfo		84-9732-016-6	2001	
J. F. Shackelford	Introducción a la Ciencia de Materiales para Ingenieros	Prentice Hall		978-84-8322-659-9	2010	
J.M. Montes, F.G. Cuevas y J. Cintas	Ciencia e Ingeniería de los materiales	Paraninfo		978-84-283-3017-6	2014	
W.D.Calister, Jr.	Introducción a la Ciencia e Ingeniería de los Materiales	Reverté		84-291-7254-8	2003	
A. Dyer	An introduction to zeolite molecular sieves	John Wiley			1988	
V. Muller	Inorganic Structural Chemistry	Wiley			1992	
W.F.Smith y Javad Hashemi	Fundamentos de la Ciencia e Ingeniería de Materiales	McGraw-Hill		978-607-15-1152-2	2014	