

340052 - MAES-M5002 - Structural Materials

Coordinating unit:	340 - EPSEVG - Vilanova i la Geltrú School of Engineering
Teaching unit:	702 - CMEM - Department of Materials Science and Metallurgy
Academic year:	2019
Degree:	BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory) BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional) BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Teaching unit Optional)
ECTS credits:	6
Teaching languages:	Catalan, Spanish

Teaching staff

Coordinator:	M ^a Teresa Baile Puig
Others:	- M. TERESA BAILE PUIG - JOSEP ANTON PICAS BARRACHINA

Degree competences to which the subject contributes

Specific:

1. CE25. Knowledge and ability to apply material engineering.

Transversal:

2. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.
3. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 2. Using strategies for preparing and giving oral presentations. Writing texts and documents whose content is coherent, well structured and free of spelling and grammatical errors.
4. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.
5. EFFECTIVE USE OF INFORMATION RESOURCES - Level 2. Designing and executing a good strategy for advanced searches using specialized information resources, once the various parts of an academic document have been identified and bibliographical references provided. Choosing suitable information based on its relevance and quality.

Teaching methodology

In the theory classes the basic concepts of the subject will be explained. In the classes of problems the basic techniques for the resolution of problems will be explained and the proposed problems will be discussed, from the student's contributions. In the practical exercises will explain the basic knowledge to perform the different proposed tests and the obtained results will be interpreted and discussed.

In the out-class activities the professor supervises student's work by means of the analysis of his evolution through the evaluation activity and the guided activities. Biblio

Learning objectives of the subject

- Understand and contrast the fundamental concepts of crystalline structure and microstructure of the different types of materials
- Select the chemical/physical/mechanical magnitudes of the materials necessities in accordance with the specifications of a product.
- Understand the relation between the microstructure, the processing and the materials properties.



340052 - MAES-M5002 - Structural Materials

- Select of materials based on their chemical, thermal, electrical, magnetic and mechanical properties
- Applies the standards of tests.
- It uses and It interprets the tests and it analyzes the results

Study load

Total learning time: 150h	Hours large group:	30h	20.00%
	Hours medium group:	0h	0.00%
	Hours small group:	30h	20.00%
	Guided activities:	0h	0.00%
	Self study:	90h	60.00%

340052 - MAES-M5002 - Structural Materials

Content

Content 1: Ferrous alloys: Aliatges Fe-C (steel and cast iron)

Learning time: 28h 40m

Theory classes: 3h
Practical classes: 2h
Laboratory classes: 8h
Guided activities: 0h 40m
Self study : 15h

Description:

Properties of the Fe. Ferrous alloys: diagrams, reactions, structures, steels and cast irons. Transformations of austenite

Related activities:

Activity 1: Expositive class
Activity 2: Exercises of content 1
Activity 3: Steel diagram 1^a part (computer program)
Activity 4: Practice of steel and cast iron metallography
Activity 11: Test of steel and cast iron knowledge
Activity 17: Final test

Specific objectives:

Fundamental knowledge acquisition on the Fe-C alloys

340052 - MAES-M5002 - Structural Materials

<p>Content 2: Classification of steels and cast irons</p>	<p>Learning time: 24h 40m</p> <p>Practical classes: 2h Laboratory classes: 6h Guided activities: 1h 40m Self study : 15h</p>
<p>Description:</p> <ul style="list-style-type: none"> Plain carbon steels. Low-alloy steels Alloy steels and super-alloy steels. Special steels. Cast irons <p>Related activities:</p> <ul style="list-style-type: none"> Activity 5: Seminary of steel and cast iron classification Actividad 6: Works in small group of content 2 Actividad 11: Test of steel and cast iron knowledge Actividad 17: Final test <p>Specific objectives:</p> <ul style="list-style-type: none"> It relates the microstructure, the processing and the properties of steel and cast iron It selects materials based on his physical, chemical, thermal and mechanical properties 	

340052 - MAES-M5002 - Structural Materials

<p>Content 3: Heat treatments of ferrous alloys</p>	<p>Learning time: 32h 40m</p> <p>Theory classes: 3h Practical classes: 4h Laboratory classes: 8h Guided activities: 0h 40m Self study : 17h</p>
<p>Description: Heat treatments Surface treatments</p> <p>Related activities: Activity 1: Expositive class Activity 7: Exercises of content 3 Actividad3: Steel diagram 2^a part (computer program) Actividad 8: Practice of micro-hardnesses Actividad 9: Practice of hardenability: Jominy test Actividad 10: Practice of pyrometry Actividad11: Test of steel and cast iron knowledge Actividad17: Final test</p> <p>Specific objectives: Fundamental knowledge acquisition of the heat treatments of ferric alloys</p>	

340052 - MAES-M5002 - Structural Materials

<p>Content 4: Non ferric alloys</p>	<p>Learning time: 24h 40m</p> <p>Theory classes: 4h Practical classes: 3h Laboratory classes: 4h Guided activities: 0h 40m Self study : 13h</p>
<p>Description:</p> <p>Aluminum and its alloys Magnesium and its alloys Titanium and its alloys Copper and brases</p> <p>Related activities:</p> <p>Actividad1: Expositive class Actividad12: Exercises of content 4 Actividad13: Practice of non ferric alloy characterization Actividad17: Final test</p> <p>Specific objectives:</p> <p>Knowledge of non ferrous materials</p>	

340052 - MAES-M5002 - Structural Materials

<p>Content 5: Polymers</p>	<p>Learning time: 21h 40m</p> <p>Theory classes: 3h Practical classes: 2h Laboratory classes: 2h Guided activities: 1h 40m Self study : 13h</p>
<p>Description: Polymers. Classification of polymers. Polymer properties</p> <p>Related activities: Actividad1: Expositive class Actividad14: Exercises of content 5 Actividad15: Practice polymers Actividad17: Final test</p> <p>Specific objectives: Knowledge polymeric materials</p>	
<p>Contingut 6: Ceramics and composites</p>	<p>Learning time: 9h</p> <p>Theory classes: 4h Guided activities: 1h Self study : 4h</p>
<p>Description: Ceramics and glasses Mechanical properties Composites</p> <p>Related activities: Actividad1: Expositive class Actividad16: Exercises of content 6 Actividad17: Final test</p> <p>Specific objectives: Knowledge ceramic and composite materials</p>	

340052 - MAES-M5002 - Structural Materials

Qualification system

Individual written tests: 70%

Development of the laboratory practices: 20%

Presentation and evaluation of proposed problems (individual or in group): 10%

The evaluation of the course will be based on the following indicators:

T, Theory, : average midterm 1, PT1, and midterm 2, PT2.

P, Exercises or completed questionnaires: mean of the different performed exercises.

L Labs: weighted average of the different scheduled practices.

F, Final Theory Test.

The qualification of this matter will be obtained by applying the most favorable of the following ratios:

1.

Theory, T: 70% of the final note (average of the two partials)

Solved exercises, P: 10% of the final

Labs, L: 20% of the final

Final score $T = 0.7T + 0.2P + 0.1L$

2.

Theory, F: 70% of the final exam)

Solved exercises, P: 10% of the final note

Labs, L: 20% of the final note

Final Score = $0.7F + 0.1P + 0.2L$

The laboratory practices, the tests carried out via Campus Digital and the activities carried out in the classroom during the regular period of classes (problems and / or presentations of work) will not be re-evaluated.

The completion and presentation of the corresponding reports of at least 75% of the laboratory practices will be a necessary condition for the approval of the subject.

Regulations for carrying out activities

All the planned activities in this subject have a part in which the students have to attend in person and another part in which the students have to do an independent learning. Before the classes of problems the students will individually discuss individually or in small groups the proposed problems and will have to present their solution. The evaluation of this task will influence in the evaluation. For the practical exercises in the laboratory the students have to previously know the fundamentals of each test and knowledge that results are expected for each test.

340052 - MAES-M5002 - Structural Materials

Bibliography

Basic:

Ashby, M. F.; Jones, David R. H. *Materiales para ingeniería*. Barcelona: Reverté, 2008-2009. ISBN 9788429172577.

Smith, William F.; Hashemi, Javad. *Fundamentos de ciencias e ingenierías de materiales*. 4a ed. México [etc.]: McGraw-Hill, 2006. ISBN 9701056388.

Askeland, Donald R / Wright, Wendelin J.. *Ciencia e ingeniería de materiales*. 7ª. Mèxic: Cengage Learning, 2017. ISBN 978-1-305-07710-2.

Callister, William D; Rethwisch, David G. *Ciencia e ingeniería de materiales*. 2a ed. Barcelona [etc.]: Reverté, 2016. ISBN 9788429172515.

Complementary:

ASM handbook. Vol. 1, *Properties and selection: iron, steels, and high-performance alloys*. 6th ed. Materials Park, Ohio: ASM International, 1995. ISBN 0871703777.

Béranger, Gérard. *Le Livre de l'acier*. Londres [etc.]: Technique & Documentation-Lavoisier, 1994. ISBN 2852069814.

Polmear, I.J. *Light Alloys [Recurs electrònic] : from traditional alloys to nanocrystals [on line]*. 4th ed. Amsterdam [etc.]: Elsevier, 2006 [Consultation: 20/09/2016]. Available on: <<http://www.sciencedirect.com/science/book/9780750663717>>. ISBN 9780750663717.

Mangonon, Pat L. *Ciencia de materiales : selección y diseño*. México [etc.]: Prentice Hall, 2001. ISBN 9702600278.

Others resources:

Hyperlink

<http://www.matter.org.uk/steelmatter/>

<http://aluminium.matter.org.uk/content/html/eng/default.asp?catid=&pageid=1>

<http://aluminium.matter.org.uk/aluselect/>

<http://www.matter.org.uk/steelmatter/>

<http://www.matweb.com/index.aspx>

Computer material

Materials Science on CD-ROM version 2.1