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340052 - MAES-M5O02 - 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: 2018

Degree: BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING (Syllabus 2009). (Teaching unit Optional)
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: Mª 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 necessaries in accordance with the specifications of

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a product.
-Understand the relation between the microstructure, the processing and the materials properties.
-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%

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Content

Content 1: Ferrous alloys: Aliatges Fe-C

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 1ª part (computer program)
Activity 4: Practice of steel metallography
Activity 11: Test of steel knowledge
Activity 18: Final test

Specific objectives:
Fundamental knowledge acquisition on the Faith alloys

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Content 2: Heat treatments ferrous alloys

Learning time: 32h 40m

Theory classes: 3h
Practical classes: 4h
Laboratory classes: 8h
Guided activities: 0h 40m
Self study : 17h

Description:
Heat treatments
Surface treatments

Related activities:
Activity 1: Expositive class
Activity 5: Exercises of content 2
Actividad3: Steel diagram 2ª part (computer program)
Actividad6: Practice of micro-hardnesses
Actividad7: Practice of hardenability: Jominy test
Actividad8: Practice of pyrometry
Actividad11: Test of steel knowledge
Actividad18: Final test

Specific objectives:
Fundamental knowledge acquisition of the heat treatments of ferric alloys

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Content 3: Classification of steels

Learning time: 24h 40m

Practical classes: 2h
Laboratory classes: 6h
Guided activities: 1h 40m
Self study : 15h

Description:
Plain carbon steels.
Low-alloy steels
Alloy steels and super-alloy steels.
Special steels.

Related activities:
Activity 9: Seminary of steel classification
Actividad10: Works in small group of content 3
Actividad11: Test of steel knowledge
Actividad18: Final test

Specific objectives:
It relates the microstructure, the processing and the properties of steel
It selects materials based on his physical, chemical, thermal and mechanical properties

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Content 4: Cast Irons

Learning time: 17h 40m

- Theory classes: 2h
- Practical classes: 2h
- Laboratory classes: 2h
- Guided activities: 0h 40m
- Self study : 11h

Description:
Properties of Cast Irons
White Cast Irons. Gray Cast Irons. Nodular Cast Irons.
Heat treatments of Cast Irons

Related activities:
Actividad1: Expositive class
Actividad12: Exercises of content 4
Actividad13: Practice of metallography of Cast Irons
Actividad18: Final test

Specific objectives:
Know ferrous materials

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Content 5: Non ferric alloys

Learning time: 24h 40m

Theory classes: 4h
Practical classes: 3h
Laboratory classes: 4h
Guided activities: 0h 40m
Self study : 13h

Description:
Aluminum and its alloys
Magnesium and its alloys
Titanium and its alloys
Copper and brasses

Related activities:
Actividad1: Expositive class
Actividad14: Exercises of content 5
Actividad15: Practice of non ferric alloy characterization
Actividad18: Final test

Specific objectives:
Know non ferrous materials

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Content 6: Materials non metallic

Learning time: 21h 40m

Theory classes: 3h
Practical classes: 2h
Laboratory classes: 2h
Guided activities: 1h 40m
Self study : 13h

Description:
Ceramic and glasses. Mechanical ceramic properties and glasses
Polymers. Thermo-mechanical polymer properties
Composites.

Related activities:
Actividad1: Expositive class
Actividad16: Exercises of content 6
Actividad17: Practice ceramic
Actividad18: Final test

Specific objectives:
Know non metallic materials

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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 +0.1 L

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 = 0.7 F +0.1 P +0.2 L

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.

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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. Ciencia e ingeniería de los materiales. Madrid: International Thomson Editores, 2001. ISBN 8497320166.

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.

Béranguer, 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 nanocystals [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