



Course guides

295701 - MAME - Metallic Materials

Last modified: 19/06/2020

Unit in charge: Barcelona East School of Engineering
Teaching unit: 702 - CEM - Department of Materials Science and Engineering.

Degree: BACHELOR'S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Compulsory subject).

Academic year: 2020 **ECTS Credits:** 6.0 **Languages:** Catalan, English, Spanish

LECTURER

Coordinating lecturer: JESSICA CALVO MUÑOZ

Others: Primer quadrimestre:
JESSICA CALVO MUÑOZ - M11, M12
CASIMIR CASAS QUESADA - M11, M12

PRIOR SKILLS

Knowledge of physical metallurgy

REQUIREMENTS

METAL·LÚRGIA FÍSICA - Precorequisit

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

1. Knowledge on several types of materials' structure, as well as analysis characterisation and techniques of materials.
2. Knowledge on mechanical, electronic, chemical and biologic behaviour of materials, and capacity to apply this behaviour into design, calculation and modelling of aspects of elements, components and equipment.
3. Knowledge and application of materials' technology in the following fields: production, transformation, processing, selection, control, maintenance, recycling, and storage of any type of materials.
4. Knowledge of science, technology and materials' chemistry fundamentals. Understanding the relation between microstructure, synthesis or processing and materials' properties.

Transversal:

07 AAT N3. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

TEACHING METHODOLOGY

This course will have a part of theory lectures, problems and lab practices. The theory lectures will mainly be given as exhibitions, whereas the problem lectures and lab practices will be participative and cooperative.



LEARNING OBJECTIVES OF THE SUBJECT

The main objective of the subject is that the student acquires a wide vision of the metallic alloys interesting for industrial use. The most common ferrous and non-ferrous alloys will be described emphasising its mechanical properties, thermal treatments and transformation processes most characteristics for all the family.

By the end of the course the student will have to be able to:

- Classify the main families of metallic materials and its alloys and compare its mechanical and physical properties.
- Describe the hardening mechanisms for each material and control them to achieve the properties wished
- Describe and formulate extraction and process means for the manufacturing of metallic components with structural usefulness

STUDY LOAD

| Type | Hours | Percentage |
|-------------------|-------|------------|
| Hours small group | 15,0 | 10.00 |
| Hours large group | 45,0 | 30.00 |
| Guided activities | 90,0 | 60.00 |

Total learning time: 150 h

CONTENTS

Lesson 1 - Introduction

Description:

Classification of metals and its main alloys. Description of the main characteristics of the different metallic families.

Full-or-part-time: 3h

Theory classes: 2h

Self study : 1h

Lesson 2 - Ferrous alloys

Description:

Fe-C phase diagram and phase transformations in steels. TTT and CCT diagrams . Thermal treatments. General steels for construction. Steel for sheets. Steel for tools. Stainless steel. Cast iron.

Full-or-part-time: 56h

Theory classes: 12h

Practical classes: 5h

Laboratory classes: 6h

Self study : 33h

Lesson 3 - Cooper and its alloys

Description:

Pure cooper. Brass , alloys and applications. Bronze, alloys and applications. Other cooper alloys.

Full-or-part-time: 29h

Theory classes: 5h

Practical classes: 3h

Laboratory classes: 3h

Self study : 18h



Lesson 4 - Light alloys

Description:

Wrought Aluminium alloys, heat treatable and non-heat treatable. Cast alloys. Alfa titanium alloys and their applications. Alfa+beta titanium alloys and their applications. Beta titanium alloys and their applications. Main cast and wrought magnesium alloys Magnesium applications.

Full-or-part-time: 35h

Theory classes: 6h

Practical classes: 3h

Laboratory classes: 6h

Self study : 20h

Lesson 5 - Superalloys

Description:

Nickel and cobalt base alloys. Aging principles in superalloys. Directional and single crystals solidification.

Full-or-part-time: 9h

Theory classes: 2h

Practical classes: 1h

Self study : 6h

Lesson 6 - Other families of metallic materials

Description:

Zinc base alloys. Tin base alloys. Lead base alloys. Heat resistant metals. Metallic glasses. Intermetallic .

Full-or-part-time: 18h

Theory classes: 3h

Practical classes: 3h

Self study : 12h

GRADING SYSTEM

50% final exam + 20% midterm exam + 15 % Laboratory practices + 15% Activities proposed during the lectures

EXAMINATION RULES.

There will be two exams, partial and final. The practices will also be assessed based on the reports the students will have to make. The activities proposed by the professor will be problems or activities oriented to work a specific subject. These activities will have to be done at home or during the lecturing time in the class. There will be between 3 and 5 activities during the whole semestre.



BIBLIOGRAPHY

Basic:

- Avner, Sidney H. Introducción a la metalurgia física. 2ª ed. México ; Madrid: McGraw Hill, 1979. ISBN 9686046011.
- Polmear, I. J. Light Alloys : from traditional alloys to nanocrystals [on line]. 4th ed. Amsterdam: Elsevier, cop. 2006 [Consultation: 29/05/2020]. Available on: <http://www.sciencedirect.com/science/book/9780750663717>. ISBN 9780750663717.
- Bhadeshia, H. K. D. H.; Honeycombe, R. W. K. Steels : microstructure and properties [on line]. 3rd ed. Amsterdam: Elsevier, cop. 2006 [Consultation: 29/05/2020]. Available on: <http://www.sciencedirect.com/science/book/9780750680844>. ISBN 9780750680844.
- Callister, William D. Introducción a la ciencia e ingeniería de los materiales. 2a ed. México: Limusa Wiley, 2009. ISBN 9786075000251.

RESOURCES

Audiovisual material:

- <http://www.steeluniversity.org/content/html/eng/default.asp?catid=1&pageid=1016899460>