

Course guide

340097 - CIMA-D2002 - Materials Science

Last modified: 21/06/2023

Unit in charge: Vilanova i la Geltrú School of Engineering
Teaching unit: 702 - CEM - Department of Materials Science and Engineering.

Degree: BACHELOR'S DEGREE IN INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: JOSEP ANTON PICAS BARRACHINA - JOAN VICENT CASTELL BALAGUER

Primer quadrimestre:
JOAN VICENT CASTELL BALAGUER - Grup: D2011, Grup: D2012

Segon quadrimestre:
JOSEP ANTON PICAS BARRACHINA - Grup: D2611, Grup: D2612

Others:

Primer quadrimestre:
JOAN VICENT CASTELL BALAGUER - Grup: D2011, Grup: D2012
ISABEL ESPINOSA HERNÁNDEZ - Grup: D2012
TEODORO MUNIATEGUI PUIG - Grup: D2011

Segon quadrimestre:
MARIA TERESA BAILE PUIG - Grup: D2511, Grup: D2512, Grup: D2521
ISABEL ESPINOSA HERNÁNDEZ - Grup: D2611
OSCAR MARTÍN RAYA - Grup: D2512
SERGI MENARGUES MUÑOZ - Grup: D2521
SANTIAGO MESTRES OLIVELLA - Grup: D2612
TEODORO MUNIATEGUI PUIG - Grup: D2511
JOSEP ANTON PICAS BARRACHINA - Grup: D2611, Grup: D2612

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

1. CE9. Basic knowledge of science, technology and material chemistry. Understand relation between microstructure, synthesis or processing and material properties.
2. CE25. Knowledge and ability to apply material engineering.

Transversal:

3. 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.
4. 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.
5. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.
6. 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 the student's work by means of the analysis of his evolution through the evaluation activity and the guided activities.

LEARNING OBJECTIVES OF THE SUBJECT

1. Understand and contrast the fundamental concepts of crystalline structure and microstructure of the different types of materials
2. Select the chemical/physical/mechanical magnitudes of the materials necessities in accordance with the specifications of a product.
3. Understand the relation between the microstructure, the processing and the materials properties.
4. Know the effect the material microstructure in its mechanical, electrical and magnetic behavior.
5. Select of materials based on their chemical, thermal, electrical, magnetic and mechanical properties
6. Applies the standards of tests.
7. Be able to adapt to the new technologies and new materials.

STUDY LOAD

Type	Hours	Percentage
Self study	90,0	60.00
Hours small group	30,0	20.00
Hours large group	30,0	20.00

Total learning time: 150 h

CONTENTS

1. Introduction to Science and Engineering of Materials

Description:

- 1.1 Science, Technology and Engineering of materials
- 1.2 Types of materials. Structural materials. Functional materials

Specific objectives:

Introduce to the student in the science and engineering of materials
Understand the types of materials and their classification.
Know the historical evolution of materials.

Related activities:

- Activity 1: Expositive class.
- Activity 2: Visit to laboratories.
- Activity 3: Bibliographical research
- Activity 16. Partial test
- Activity 17: Final test

Related competencies :

- . CE25. Knowledge and ability to apply material engineering.
- . CE9. Basic knowledge of science, technology and material chemistry. Understand relation between microstructure, synthesis or processing and material properties.
- 07 AAT N2. 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.
- 04 COE N2. 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.
- 05 TEQ N2. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.
- 06 URI N2. 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.

Full-or-part-time: 12h

- Theory classes: 2h
- Laboratory classes: 6h
- Self study : 4h

2. Crystalline structure of materials

Description:

- 2.1 Crystalline structure. Crystallographic parameters and Bravais lattices
- 2.2 Main crystalline structures. Factor of packing.
- 2.3 Polymorphism and Allotropy.
- 2.4 Density: linear, planar and volumetric
- 2.5 X-ray diffraction: Bragg law
- 2.6 Crystal defects: punctual, linear or dislocations and superficial.

Specific objectives:

- Know the concept of crystal
- Learn the crystallographic parameters
- Know the concept of density of a crystal.

Related activities:

- Activity 1: expositive class
- Activity 16. Partial test
- Activity 17: Final test

Related competencies :

- . CE25. Knowledge and ability to apply material engineering.
- . CE9. Basic knowledge of science, technology and material chemistry. Understand relation between microstructure, synthesis or processing and material properties.
- 07 AAT N2. 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.
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Full-or-part-time: 8h 50m

Theory classes: 2h

Guided activities: 0h 50m

Self study : 6h

3. Diffusion

Description:

5.1 Diffusion mechanisms.

5.2 Fick's laws

5.3 Diffusion and treatments of materials (applications)

Specific objectives:

Know the concept of diffusion.

Analyze and understand the solution of the Fick's laws and its application to real cases.

Related activities:

Activity 1: expositive class

Activity 13. Problems of diffusion. Applications of the Fick's laws to practical examples.

Activity 16: Partial test

Activity 17: Final test

Related competencies :

. CE25. Knowledge and ability to apply material engineering.

. CE9. Basic knowledge of science, technology and material chemistry. Understand relation between microstructure, synthesis or processing and material properties.

07 AAT N2. 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.

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Full-or-part-time: 6h 30m

Practical classes: 2h

Guided activities: 1h 30m

Self study : 3h

4. Properties of materials

Description:

- 4.1 Mechanical properties.
- 4.2 Plastic deformation Mechanisms. Hardening mechanisms.
- 4.3 Electrical, magnetic and thermal properties.

Specific objectives:

Know the main properties of materials: Mechanical, electrical, magnetic and thermal properties.

Related activities:

- Activity 1. expositive class
- Activity 6. Problems related to the tensile test. Graphic stress-strain.
- Activity 7. Practice of laboratory: Tensile test
- Activity 8. Practice of laboratory: Hardness test (Brinell, Vickers, Rockwell) and micro-hardness test
- Activity 9. Practice of laboratory: Charpy impact test.
- Activity 10. Problems of electrical and magnetic properties
- Activity 11. Practice of laboratory: Measures of resistivity
- Activity 12. Practice of laboratory: Magnatest
- Activity 16. Partial test
- Activity 17: Final test

Related competencies :

- . CE25. Knowledge and ability to apply material engineering.
- . CE9. Basic knowledge of science, technology and material chemistry. Understand relation between microstructure, synthesis or processing and material properties.
- 07 AAT N2. 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.
- 04 COE N2. 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.
- 05 TEQ N2. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.
- 06 URI N2. 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.

Full-or-part-time: 47h 50m

Theory classes: 3h

Practical classes: 4h

Laboratory classes: 14h

Guided activities: 0h 50m

Self study : 26h

5. Equilibrium diagrams or phase diagrams

Description:

- 6.1 Solidification of a pure metal.
- 6.2 Equilibrium diagrams.
- 6.3 Invariant reactions.
- 6.4 Types of diagrams and interpretation.

Specific objectives:

- Know the process of solidification of a pure metal.
- Know what an equilibrium phase diagram is.
- Know how to work with an equilibrium diagram and get information about the characteristics of a binary alloy.

Related activities:

- Activity 1: Expositive class
- Activity 14: Problems of equilibrium diagrams.
- Activity 15: Practice of laboratory: equilibrium diagrams (software)
- Activity 17: Final test

Related competencies :

- . CE25. Knowledge and ability to apply material engineering.
- . CE9. Basic knowledge of science, technology and material chemistry. Understand relation between microstructure, synthesis or processing and material properties.
- 07 AAT N2. 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.
- 04 COE N2. 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.
- 05 TEQ N2. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.
- 06 URI N2. 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.

Full-or-part-time: 36h 30m

- Theory classes: 2h
- Practical classes: 6h
- Laboratory classes: 6h
- Guided activities: 0h 30m
- Self study : 22h

6. Heat treatments of metallic materials

Description:

7.1 Types of heat treatments

7.2 Heat treatments of quenching and tempering

7.3 Heat treatments of solution and aging.

Specific objectives:

Know what a heat treatment is.

Learn the effect of a heat treatment on the material properties.

Related activities:

Activity 1: expositive class

Activity 17: Final test

Related competencies :

. CE25. Knowledge and ability to apply material engineering.

. CE9. Basic knowledge of science, technology and material chemistry. Understand relation between microstructure, synthesis or processing and material properties.

07 AAT N2. 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.

04 COE N2. 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.

05 TEQ N2. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.

06 URI N2. 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.

Full-or-part-time: 10h 30m

Theory classes: 2h

Guided activities: 0h 30m

Self study : 8h

7. Types of Materials

Description:

- 3.1 Metallic materials: Metallic alloys; Main processes of conformation.
- 3.2 Ceramic materials: crystalline and non-crystalline (glasses) ceramics; Processes of conformation.
- 3.3 Polymeric materials: Types of polymers (thermoplastics, thermosetables and elastomers).
- 3.4 Composites: General characteristics; Types of composites.

Specific objectives:

- Know the different types of materials
- Learn the basic processes used for the conformation of materials

Related activities:

- Activity 1: expositive class
- Activity 5. Practice of laboratory: Metallography (preparation of metallographic samples and observation by optical microscopy).
- Activity 17: Final test

Related competencies :

- . CE25. Knowledge and ability to apply material engineering.
- . CE9. Basic knowledge of science, technology and material chemistry. Understand relation between microstructure, synthesis or processing and material properties.
- 07 AAT N2. 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.
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Full-or-part-time: 27h 50m

- Theory classes: 5h
- Practical classes: 3h
- Laboratory classes: 4h
- Guided activities: 0h 50m
- Self study : 15h

ACTIVITIES

ACTIVITY 1: EXPOSITIVE CLASS

Description:

Expositive class with some solved practical exercises by the professor.

Specific objectives:

Fundamental knowledge acquisition that it would be used in the other activities.

Material:

Provided material by the professor via Digital Campus, bibliography and specific software.

Delivery:

The acquired knowledge would be evaluated in the first and the second exams (activities 16 and 17).

Related competencies :

- . CE25. Knowledge and ability to apply material engineering.
- . CE9. Basic knowledge of science, technology and material chemistry. Understand relation between microstructure, synthesis or processing and material properties.

Full-or-part-time: 56h

Theory classes: 16h

Guided activities: 4h

Self study: 36h

ACTIVITY 2: WELCOME PLAN

Description:

Welcome to the new students. To inform about the Department and about the facilities that will be used. To inform about the general and specific risks of the Laboratories where the Department conducts specific teaching. Inform about the emergency plan.

Specific objectives:

See the equipment used in the EPSEVG to the material characterization.

Material:

Nothing

Delivery:

Questionnaire

Related competencies :

- . CE25. Knowledge and ability to apply material engineering.
- . CE9. Basic knowledge of science, technology and material chemistry. Understand relation between microstructure, synthesis or processing and material properties.

Full-or-part-time: 2h

Laboratory classes: 2h

ACTIVITY 3: PRACTICE OF LABORATORY: BIBLIOGRAPHICAL RESEARCH

Description:

The student will learn how looking for information related to the subject, both in the library of the EPSEVG or by Internet search in specialized journals, data bases, etc.

Specific objectives:

Know where it is the recommended bibliography in the library of the EPSVG.

Learn to look for information in bases of the UPC.

Learn to look for information in data bases external to the UPC or in specialized journals.

Material:

Practice dossier (available in the digital campus), bibliography.

Delivery:

When the student finishes the practice he/she will have to give the corresponding report. The evaluation of the task will contribute to a 20% of the final mark.

Related competencies :

. CE25. Knowledge and ability to apply material engineering.

. CE9. Basic knowledge of science, technology and material chemistry. Understand relation between microstructure, synthesis or processing and material properties.

04 COE N2. 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.

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05 TEQ N2. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.

07 AAT N2. 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.

Full-or-part-time: 6h

Laboratory classes: 4h

Self study: 2h

ACTIVITY 5: PRACTICE OF LABORATORY: METALLOGRAPHY

Description:

The student will have to learn prepare a metallographic sample and use an optical microscope.

Specific objectives:

Learn to prepare metallographic samples for its observation.

Observation of the microstructure of different materials.

Material:

Practice dossier (available in the digital campus), bibliography.

Delivery:

When the student finishes the practice he/she will have to give the corresponding report. The evaluation of the task will contribute to a 20% of the final mark.

Related competencies :

. CE25. Knowledge and ability to apply material engineering.

. CE9. Basic knowledge of science, technology and material chemistry. Understand relation between microstructure, synthesis or processing and material properties.

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07 AAT N2. 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.

Full-or-part-time: 7h

Laboratory classes: 4h

Self study: 3h

ACTIVITY 6: PROBLEMS RELATED TO THE TENSILE TEST.

Description:

The student will have to solve the problems proposed by the professor.

Specific objectives:

Acquire ability in the use of stress σ strain graphics.

Calculate the mechanical properties that are derived from a tensile test: maximum resistance, elastic limit, elastic module and elongation.

Determine the coefficient of hardening of a metal from the data of a tensile test.

Material:

List of problems, bibliography and specific software.

Delivery:

The students will have to present by oral or written form some of the resolute problems. The acquired knowledge would be evaluated in the first and second exams that among others evaluate this subject (Activities 16 and 17).

Related competencies :

. CE25. Knowledge and ability to apply material engineering.

. CE9. Basic knowledge of science, technology and material chemistry. Understand relation between microstructure, synthesis or processing and material properties.

04 COE N2. 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.

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07 AAT N2. 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.

Full-or-part-time: 8h

Practical classes: 2h

Self study: 6h

ACTIVITAT 7: PRACTICE OF LABORATORY: TENSILE TEST

Description:

The student will perform a tensile test in two different materials: an aluminium alloy and steel.

Specific objectives:

Know the procedure of a tensile test machine

Learn to determine the mechanical properties of a material from a real tensile test.

Determine the coefficient of hardening of a metal from the real data of a tensile test.

Interpret and analyze the results.

Apply standards to carry out the test.

Material:

Practice dossier (available in the digital campus), bibliography, standards to carry out the test, specific software.

Delivery:

When the student finishes the practice he/she will have to give the corresponding report. The evaluation of the task will contribute to a 20% of the final mark.

Related competencies :

. CE25. Knowledge and ability to apply material engineering.

. CE9. Basic knowledge of science, technology and material chemistry. Understand relation between microstructure, synthesis or processing and material properties.

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07 AAT N2. 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.

Full-or-part-time: 6h

Laboratory classes: 4h

Self study: 2h

ACTIVITY 8: PRACTICE OF LABORATORY: HARDNESS TEST (BRINELL, VICKERS, ROCKWELL) AND MICROHARDNESS

Description:

The student will perform a hardness test in different materials: an aluminum alloy, a copper alloy and steel.

Specific objectives:

Know the procedure of a hardness equipment

Learn to determine the hardness of a material by means of the different types of hardness: Brinell, Vickers, Rockwell

Learn to determine the micro-hardness of a material by means of a micro-hardness Vickers test.

Interpret and analyze the results.

Apply standards to carry out the test.

Material:

Practice dossier (available in the digital campus), bibliography and standards to carry out the test.

Delivery:

When the student finishes the practice he/she will have to give the corresponding report. The evaluation of the task will contribute to a 20% of the final mark.

Related competencies :

. CE25. Knowledge and ability to apply material engineering.

. CE9. Basic knowledge of science, technology and material chemistry. Understand relation between microstructure, synthesis or processing and material properties.

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07 AAT N2. 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.

Full-or-part-time: 6h

Laboratory classes: 4h

Self study: 2h

ACTIVITY 9: PRACTICE OF LABORATORY: CHARPY IMPACT TEST.

Description:

The student will perform an impact test in steels with and without heat treatment (quenching and tempering).

Specific objectives:

Know the procedure of a Charpy pendulum
Learn to determine the Resilience of a material.
Learn the concepts of toughness and fragility
Interpret and analyze the results.
Apply standards to carry out the test.

Material:

Practice dossier (available in the digital campus), bibliography and standards to carry out the test.

Delivery:

When the student finishes the practice he/she will have to give the corresponding report. The evaluation of the task will contribute to a 20% of the final mark.

Related competencies :

. CE25. Knowledge and ability to apply material engineering.
. CE9. Basic knowledge of science, technology and material chemistry. Understand relation between microstructure, synthesis or processing and material properties.
04 COE N2. 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.
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07 AAT N2. 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.

Full-or-part-time: 4h

Laboratory classes: 2h

Self study: 2h

ACTIVITY 10: PROBLEMS OF ELECTRICAL AND MAGNETIC PROPERTIES

Description:

The student will have to solve the problems proposed by the professor.

Specific objectives:

Know the main concepts of electrical conductivity and magnetism.

Learn how to determine the resistivity of materials and alloys.

Calculate the main magnetic variables (permeability, magnetization, etc.)

Material:

List of problems, bibliography and specific software.

Delivery:

The students will have to present by oral or written form some of the resolute problems. The acquired knowledge would be evaluated in the first and second exams that among others evaluate this subject (Activities 16 and 17).

Related competencies :

. CE25. Knowledge and ability to apply material engineering.

. CE9. Basic knowledge of science, technology and material chemistry. Understand relation between microstructure, synthesis or processing and material properties.

04 COE N2. 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.

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07 AAT N2. 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.

Full-or-part-time: 4h

Practical classes: 2h

Self study: 2h

ACTIVITY 11: PRACTICE OF LABORATORY: MEASURES OF RESISTIVITY

Description:

The student will determine the electrical resistivity of different steels and will evaluate the effect of the heat treatment in resistivity.

Specific objectives:

Know the use of a voltmeter/ammeter.

Learn how to determine the electrical conductivity of a material

Interpret and analyze the results.

Material:

Practice dossier (available in the digital campus) and bibliography.

Delivery:

When the student finishes the practice he/she will have to give the corresponding report. The evaluation of the task will contribute to a 20% of the final mark.

Related competencies :

. CE25. Knowledge and ability to apply material engineering.

. CE9. Basic knowledge of science, technology and material chemistry. Understand relation between microstructure, synthesis or processing and material properties.

04 COE N2. 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.

06 URI N2. 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.

05 TEQ N2. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.

07 AAT N2. 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.

Full-or-part-time: 4h

Laboratory classes: 2h

Self study: 2h

ACTIVITY 13: PROBLEMS OF DIFFUSION. APPLICATIONS OF THE FICK'S LAWS TO PRACTICAL EXAMPLES.

Description:

The student will have to solve the problems proposed by the professor.

Specific objectives:

Know the main diffusion concepts.

Determine the diffusivity and evaluate the temperature effect.

Analyze and understand the solution of the Fick's laws and its application to real situations.

Material:

List of problems, bibliography and specific software.

Delivery:

The students will have to present by oral or written form some of the resolute problems. The acquired knowledge would be evaluated in the first and second exams that among others evaluate this subject (Activities 16 and 17).

Related competencies :

. CE25. Knowledge and ability to apply material engineering.

. CE9. Basic knowledge of science, technology and material chemistry. Understand relation between microstructure, synthesis or processing and material properties.

04 COE N2. 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.

06 URI N2. 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.

05 TEQ N2. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.

07 AAT N2. 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.

Full-or-part-time: 3h

Practical classes: 2h

Self study: 1h

ACTIVITY 12: PRACTICE OF LABORATORY: MAGNATEST

Description:

The student will evaluate the microstructural differences between steel with different heat treatments from his different magnetic behavior.

Specific objectives:

Know the use of the Magnatest equipment.

Evaluate the effect of the microstructure in the electrical and magnetic properties of a metallic material.

Know the applications of the equipment in the quality control of industrial processes.

Interpret and analyze the results.

Material:

Practice dossier (available in the digital campus) and bibliography.

Delivery:

When the student finishes the practice he/she will have to give the corresponding report. The evaluation of the task will contribute to a 20% of the final mark.

Related competencies :

. CE25. Knowledge and ability to apply material engineering.

. CE9. Basic knowledge of science, technology and material chemistry. Understand relation between microstructure, synthesis or processing and material properties.

04 COE N2. 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.

06 URI N2. 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.

05 TEQ N2. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.

07 AAT N2. 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.

Full-or-part-time: 4h

Laboratory classes: 2h

Self study: 2h

ACTIVITY 14: PROBLEMS OF EQUILIBRIUM DIAGRAMS.

Description:

The student will have to solve the problems proposed by the professor.

Specific objectives:

Acquire ability in the use of binary equilibrium diagrams.

Calculate the chemical composition of phases (Rule of the horizontal)

Determine the proportion of phases (Rule of the Lever or the inverse segment)

Understand the invariant reactions.

Know the solidification process and cooling until room temperature of a metallic alloy and understand its microstructural evolution.

Material:

List of problems, bibliography and specific software.

Delivery:

The students will have to present by oral or written form some of the resolute problems. The acquired knowledge would be evaluated in the second exam that among others evaluate this subject (Activity 17).

Related competencies :

. CE9. Basic knowledge of science, technology and material chemistry. Understand relation between microstructure, synthesis or processing and material properties.

. CE25. Knowledge and ability to apply material engineering.

04 COE N2. 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.

06 URI N2. 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.

05 TEQ N2. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.

07 AAT N2. 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.

Full-or-part-time: 16h

Practical classes: 6h

Self study: 10h

ACTIVITY 16: PARTIAL TEST

Description:

The student will have to do a written test on contents 1, 2, 3 and 4, in which he/she will have to solve some exercises and questions.

Specific objectives:

Consolidation of the knowledge acquired until the moment

Material:

Exam.

Delivery:

Individual resolution of the proposed questions and exercises contributes to a 30% of the final mark.

Related competencies :

. CE25. Knowledge and ability to apply material engineering.

. CE9. Basic knowledge of science, technology and material chemistry. Understand relation between microstructure, synthesis or processing and material properties.

04 COE N2. 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.

Full-or-part-time: 2h 30m

Theory classes: 1h 30m

Guided activities: 1h

ACTIVITY 15: PRACTICE OF LABORATORY: EQUILIBRIUM DIAGRAMS.

Description:

The student will acquire the knowledge necessary to work and to obtain data of simple equilibrium diagrams.

Specific objectives:

Acquire ability in the use of binary equilibrium diagrams.

Calculate the chemical composition of phases (Rule of the horizontal)

Determine the proportion of phases (Rule of the Lever or the inverse segment)

Understand the invariant reactions.

Know the solidification process and cooling until room temperature of a metallic alloy and understand its microstructural evolution.

Material:

Practice dossier (available in the digital campus), bibliography and specific software.

Delivery:

When the student finishes the practice he/she will have to give the corresponding report. The evaluation of the task will contribute to a 20% of the final mark.

Related competencies :

. CE25. Knowledge and ability to apply material engineering.

. CE9. Basic knowledge of science, technology and material chemistry. Understand relation between microstructure, synthesis or processing and material properties.

04 COE N2. 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.

06 URI N2. 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.

05 TEQ N2. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.

07 AAT N2. 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.

Full-or-part-time: 10h

Laboratory classes: 6h

Self study: 4h

ACTIVITY 17: FINAL TEST

Description:

Written test in which the student will have to demonstrate the degree of acquisition of the knowledge acquired on the subjects explained during the course. In this test acquired knowledge about different subjects will be interrelated.

Specific objectives:

Consolidation of the knowledge acquired during the course and their interrelation.

Material:

Exam.

Delivery:

Individual resolution of the proposed questions and exercises contributes to a 30% of the final mark.

Related competencies :

. CE25. Knowledge and ability to apply material engineering.

. CE9. Basic knowledge of science, technology and material chemistry. Understand relation between microstructure, synthesis or processing and material properties.

04 COE N2. 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.

Full-or-part-time: 2h 30m

Theory classes: 1h 30m

Guided activities: 1h

ACTIVITY 4: SELECTION OF MATERIALS

Description:

The students will have to solve some questions proposed by the professor on selection of materials for an application.

Specific objectives:

Acquire ability in the utilization of Ashby's diagrams.

Understand the relation between properties.

Know the criteria selection of a material based on the requirements of exploitation

Material:

Bibliography and specific software.

Delivery:

The students will have to present, by oral or written form, some of the resolute problems. The acquired knowledge would be evaluated in the second exam that among others evaluate this subject (Activity 17).

Full-or-part-time: 9h

Practical classes: 3h

Self study: 6h

GRADING SYSTEM

Individual written tests (T): 70%. There will be a partial exam (EP1), a second partial (EP2) and/or a final exam (EF).

Laboratory practice development reports (L): 20%

Presentation and evaluation of the resolution of problems or individual questionnaires (Q): 10%

The subject will be evaluated according to the following indicators:

If $EP1 > 5$, then the student will have the option to examine only the second part of the subject (EP2). In this case the assessment will be:

If $EP2 > EP1$

$70\% EP2 + 20\% L + 10\% Q$

If $EP2$

$30\% EP1 + 40\% EP2 + 20\% L + 10\% Q$

If $EP1$

$70\% EF + 20\% L + 10\% Q$

Completion and presentation of the corresponding reports for at least 75% of the laboratory practices will be a necessary condition for the approval of the subject. Otherwise, the maximum mark for the subject will be failing, with a 4.9 (UPC, Academic regulations for Bachelor and Master studies).

The student who gets a course grade > 2 and

$70\% ER + 20\% L + 10\% Q$

According to the regulations, the maximum grade for the course, through re-evaluation, will be 7.

EXAMINATION RULES.

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. A pre-test may be required to access the laboratory for certain practices. The practice of the Welcome Plan is mandatory, its non-implementation implies the prohibition of access to the laboratories.

The accomplishment of the individual tests will be carried out in accordance with the course timetable.

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