

Course guide

340040 - CIMA-N - Materials Science

Last modified: 19/05/2026

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 ELECTRICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING AND RAILWAY SYSTEMS (Syllabus 2024). (Compulsory subject).

Academic year: 2026 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: JOAN DAVID GUTIÉRREZ CASTILLO

Others: Primer quadrimestre:
JOAN VICENT CASTELL BALAGUER - N2011, N2012, N2021, N2022
ISABEL ESPINOSA HERNÁNDEZ - N2011
JOAN DAVID GUTIÉRREZ CASTILLO - N2011, N2012, N2021, N2022
SILVIA ILLESCAS FERNÁNDEZ - N2012
SANTIAGO MESTRES OLIVELLA - N2021, N2022
EULÀLIA NOGUÉS BOADA - N2012

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.

The programmed activities are subject to the availability of space and material. The teaching language of the subject is, by default, Catalan. Once the course has started, if specific circumstances arise, at the discretion of the teaching staff involved, the language may be changed. These circumstances will have to be justified in class.

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

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
- 1.3 Historical perspective

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: Welcome plan.
- Activity 3: Bibliographical research
- Activity 17. Partial test
- Activity 18: 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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- 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.
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Full-or-part-time: 10h

Theory classes: 2h

Laboratory classes: 4h

Self study : 4h

2. Crystalline structure of materials

Description:

- 2.1 Crystalline structure. Crystallographic parameters and Bravais lattices
- 2.2 Spots, directions and planes. Indexes of Miller.
- 2.3 Crystalline structures of metals; CC, CCC i HC. Factor of packing.
- 2.4 Main crystalline structures of the ceramic materials.
- 2.5 Polymorphism and Allotropy.
- 2.6 Density: linear, planar and volumetric
- 2.7 X-ray diffraction: Bragg law
- 2.8 Crystal defects: punctual, linear or dislocations and superficial.

Specific objectives:

- Know the concept of crystal
- Learn the crystallographic parameters
- Learn the form to identify: points, directions and planes (Indexes of Miller)
- Know the concept of density of a crystal.

Related activities:

- Activity 1: expositive class
- Activity 4. Problems of crystallography (indexes of Miller, densities, etc.)
- Activity 17. Partial test
- Activity 18: Final test

Related competencies :

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- . CE9. Basic knowledge of science, technology and material chemistry. Understand relation between microstructure, synthesis or processing and material properties.
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3. 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: Polymer synthesis; Types of polymers (thermoplastics, thermostables 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. Partial test

Activity 18: Final test

Related competencies :

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

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4. Properties of materials

Description:

4.1 Mechanical properties. Tensile/compression tests, hardness, toughness.

4.2 Plastic deformation Mechanisms. Hardening mechanisms.

4.3 Electrical properties. Electrical behavior and chemical bonds. Conductors, semiconductors and insulators or dielectrics,

4.4 Magnetic properties. Types of magnetic behaviors. Magnetic domains. Cycle of magnetic hysteresis. Magnetic hardening mechanisms.

4.5 Thermal properties. Heat transfer.

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 17. Partial test

Activity 18: 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.

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5. Diffusion and solidification

Description:

- 5.1 Diffusion mechanisms.
- 5.2 Fick's laws
- 5.3 Diffusion and treatments of materials (applications)
- 5.4 Solidification of a pure metal.

Specific objectives:

- Know the concept of diffusion.
- Analyze and understand the solution of the Fick's laws and its application to real cases.
- Know the solidification process of a pure metal

Related activities:

- Activity 1: expositive class
- Activity 13: Problems of diffusion. Applications of the Fick's laws to practical examples.
- Activity 18: 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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6. Equilibrium diagrams or phase diagrams

Description:

- 6.1 Equilibrium diagrams of pure substances.
- 6.2 Construction of equilibrium or phase diagrams
- 6.3 Binary isomorphous diagram
- 6.4 Calculation of the chemical composition of phases (Rule of the horizontal) and calculation of the proportion of phases (Rule of the Lever or the inverse segment)
- 6.5 Types of diagrams and interpretation. Examples of metallic alloy diagrams.
- 6.6 Invariant reactions.
- 6.7 Examples of diagrams of ceramic materials.

Specific objectives:

- Know what an equilibrium or 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: Expository class
- Activity 14: Problems of equilibrium diagrams.
- Activity 15: Practice of laboratory: equilibrium diagrams (software)
- Activity 18: Final test

Related competencies :

- . CE25. Knowledge and ability to apply material engineering.
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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.
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7. Heat treatments of metallic materials

Description:

7.1 Types of heat treatments

7.2 Steel heat treatments: quenching and tempering

7.3 Aluminium alloy heat treatments: 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 16. Problems of heat treatments.

Activity 18: 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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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 17 and 18).

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: 13h

Theory classes: 13h

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:

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.

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 :

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Full-or-part-time: 4h

Laboratory classes: 2h

Self study: 2h

ACTIVITY 4: PROBLEMS OF CRYSTALLOGRAPHY (INDEXES OF MILLER, DENSITIES, ETC.)

Description:

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

Specific objectives:

Know the main crystallographic parameters.

Learn the form to identify: crystallographic spots, directions and planes (Indexes of Miller) To calculate the linear, superficial or volumetric density.

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 17 and 18).

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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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: 11h

Theory classes: 4h

Self study: 7h

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: 4h

Laboratory classes: 2h

Self study: 2h

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 17 and 18).

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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Full-or-part-time: 9h

Theory classes: 3h

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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Full-or-part-time: 4h

Laboratory classes: 2h

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: 4h

Laboratory classes: 2h

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.
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Full-or-part-time: 5h

Laboratory classes: 2h

Self study: 3h

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 17 and 18).

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: 6h

Theory classes: 2h

Self study: 4h

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.

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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 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.

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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: 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 second exam that among others evaluate this subject (Activity 18).

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: 8h

Theory classes: 3h

Self study: 5h

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 18).

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: 12h

Theory classes: 5h

Self study: 7h

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.

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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: 4h

Laboratory classes: 2h

Self study: 2h

ACTIVITY 16: PROBLEMS OF HEAT TREATMENTS.

Description:

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

Specific objectives:

Acquire ability in the use of binary diagrams of balance.

Understand the main heat treatments.

To know the effect the heat treatments in the properties of a material.

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 18).

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: 5h

Theory classes: 2h

Self study: 3h

ACTIVITY 17: 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: 23h

Theory classes: 3h

Self study: 20h

ACTIVITY 18: 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 :

. 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.

Full-or-part-time: 28h

Theory classes: 3h

Self study: 25h

GRADING SYSTEM

Individual written tests (T): 70%. There will be one partial exam (EP) and a final exam (EF if $EP1 < 5$ and EP2 if $EP1 \geq 5$)

Report on laboratory practices (L): 20%

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

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

- If $EP1 > 5$, then, in EF the student only takes the second part of the subject (EP2)

If $EP2 > EP1$:

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

If $EP2 < EP1$:

$NF = 70\% EP1 + 20\% L + 10\% Q$

In the reassessment the formula will be

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

The completion and presentation of the corresponding reports of at least 75% of the laboratory practices will be a necessary condition to passing the subject. Otherwise, the maximum grade for the subject will be failing grade, with a 4.9 (UPC., Academic Regulations for Bachelor's and Master's Degrees)

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. Only the part of (T) is considered re-evaluable.

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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