295023 - ECMA - Materials Structure and Characterization

**Coordinating unit:** 295 - EEBE - Barcelona East School of Engineering  
**Teaching unit:** 702 - CMEM - Department of Materials Science and Metallurgy  
**Academic year:** 2017  
**Degree:** BACHELOR’S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)  
**ECTS credits:** 6  
**Teaching languages:** Catalan, Spanish

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**Degree competences to which the subject contributes**

**Specific:**
1. Knowledge of science, technology and materials' chemistry fundaments. Understanding the relation between microstructure, synthesis or processing and materials' properties.

**Transversal:**
07 AAT N1. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

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**Teaching methodology**

Sessions will be taught in a theory, problems and laboratory practices format in which the subject's specific competencies will be introduced. Present directed activities to work on spoken and written communication and team work will take place. Autonomous learning and the solvent use of information resources by means of non-presence directed activities will also be encouraged.

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**Learning objectives of the subject**

The subject's objective is that students acquire knowledge on the fundaments of material families, their structure and defects. In addition, students will have to know the different microstructural characterisation techniques as well as knowing to interpret results obtained by means of different techniques.

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**Study load**

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group: 45h</th>
<th>30.00%</th>
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<tbody>
<tr>
<td></td>
<td>Hours medium group: 0h</td>
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<tr>
<td></td>
<td>Hours small group: 15h</td>
<td>10.00%</td>
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<td></td>
<td>Guided activities: 0h</td>
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<tr>
<td></td>
<td>Self study: 90h</td>
<td>60.00%</td>
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### Content

<table>
<thead>
<tr>
<th>TOPIC I. Engineering materials</th>
<th>Learning time: 15h</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 4h</td>
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<tr>
<td></td>
<td>Laboratory classes: 1h</td>
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<tr>
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<td>Self study: 10h</td>
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**Description:**
- Material's science and engineering.
- Types of materials: metals, ceramics and glasses, polymers, composite materials, semiconductors.
- From structure to properties.

<table>
<thead>
<tr>
<th>TOPIC II: Crystalline structures</th>
<th>Learning time: 35h</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 9h</td>
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<tr>
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<td>Practical classes: 6h</td>
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<td>Self study: 20h</td>
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**Description:**
- Unit cell.
- Crystal systems.
- Primary crystal structures (BCC, FCC, HCP)
- Crystallographic directions and planes. Miller indices.

<table>
<thead>
<tr>
<th>TOPIC III: Crystalline defects</th>
<th>Learning time: 35h</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 9h</td>
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<tr>
<td></td>
<td>Laboratory classes: 6h</td>
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<tr>
<td></td>
<td>Self study: 20h</td>
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</tbody>
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**Description:**
- Defects in crystalline materials (point defects, linear defects, planar defects, volumetric defects)
- Dislocations (Geometry of dislocations and Burgers vector)
- Movement of dislocations (dislocation glide)
TOPIC IV: Analysis of crystal structures

Description:
- Diffraction techniques: X-Ray Diffraction (properties and X-ray sources, formulation Bragg powder diffractometer)
- Spectroscopic techniques: Infrared Spectroscopy
- Identification and analysis of crystalline phases

Learning time: 20h
- Theory classes: 7h
- Laboratory classes: 3h
- Self study: 10h

TOPIC V: Polymers' structure and characterisation

Description:
- Obtaining polymers (polymerisation reactions). Average molecular mass and techniques to determine it.
- Architecture molecular (linear, ramified and reticulated) and polymer classification into thermoplastics, Thermostables and elastomers.
- Polymers' structure (amorphous and semicrystalline). Techniques to determine vitreous transmission temperature.
- Aggregation states.
- Copolymers.

Learning time: 20h
- Theory classes: 4h
- Laboratory classes: 1h
- Self study: 15h

TOPIC VI: Experimental techniques to identify microstructures and defects

Description:
- Optical metalography. Preparing samples. Grain size according to ASTM and determining the grain's diameter.
- Transmission electronic microscopy (TEM).

Learning time: 25h
- Theory classes: 7h
- Laboratory classes: 3h
- Self study: 15h

Qualification system

A student's grade will be:
Final Mark = 0.5 Final Exam + 0.3 Partial Exam + 0.2 Practices

If reassessment, the student's grade will be:
Final Mark = 0.8 Reassessment Exam + 0.2 Practices
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Bibliography

Basic:


Complementary:


Others resources:

Teaching material available in Atenea