Course guide
295759 - 295EM114 - Nanostructured Materials

Unit in charge: Barcelona East School of Engineering
Teaching unit: 702 - CEM - Department of Materials Science and Engineering.
Degree: MASTER'S DEGREE IN MATERIALS SCIENCE AND ADVANCED MATERIALS ENGINEERING (Syllabus 2019). (Optional subject).
ERASMUS MUNDUS MASTER'S DEGREE IN ADVANCED MATERIALS SCIENCE AND ENGINEERING (Syllabus 2021). (Optional subject).
Academic year: 2022 ECTS Credits: 6.0 Languages: English

LECTURER
Coordinating lecturer: Jose Maria Cabrera Marrero
Others: Jose Maria Cabrera Marrero
Crisanto Villalobos
Eloi Pineda
Casimir Casas

REQUIREMENTS
Mechanical behaviour of materials. Microstructural characterization of materials

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES
Specific:
CEMCEAM-01. (ENG) Disenyar i desenvolupar productes, processos i sistemes, aixó com l'optimització d'altres ja desenvolupats, atenent a la selecció de materials per aplicacions específiques.
CEMCEAM-02. (ENG) Aplicar métodos innovadores para el diseño, simulación, optimización y control de procesos de producción y transformación de materiales
CEMCEAM-03. (ENG) Realizar estudios de caracterización y evaluación de materiales según sus aplicaciones

TEACHING METHODOLOGY
The structure of the lecture is 6 credits. Lessons are held for three hours a week. Within these hours, laboratory practices will be carried out, which given, the complexity of the equipment and infrastructure will generally be demonstrative. One of the lab sessions will consist on the practical application of the EBSD technique, which throughout the course must be applied to a specific case, and presented in writing at the end. Also, throughout the course, students, in groups of two or three, must carry out a bibliographic work, which they will explain, share and present orally and in writing at the end of the course.
The generic competences that the student will achieve will be a) ability to understand and rationalize the materials selection process, b) ability to develop manufacturing techniques and knowledge of characterization techniques, c) ability to work as a team in the pre-project and ) technical oral and written communication skills

LEARNING OBJECTIVES OF THE SUBJECT
STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Hours small group</td>
<td>14.0</td>
<td>9.33</td>
</tr>
<tr>
<td>Hours medium group</td>
<td>28.0</td>
<td>18.67</td>
</tr>
<tr>
<td>Self study</td>
<td>102.0</td>
<td>68.00</td>
</tr>
<tr>
<td>Guided activities</td>
<td>6.0</td>
<td>4.00</td>
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</tbody>
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Total learning time: 150 h

CONTENTS

Introduction

Description:
Definitions. First approach to nanostructured materials

Full-or-part-time: 3h
Theory classes: 3h

Mechanical properties

Description:
Mechanical properties: strength and ductility. Deformation mechanism

Full-or-part-time: 6h
Theory classes: 6h

Microstructural characterization

Description:
Microstructural characterization applied to nanomaterials: EBSD, X-Ray diffraction, and others

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

Metalli glasses

Description:
Introduction, types, properties and synthesis

Full-or-part-time: 5h
Theory classes: 5h
**Processing routes: Bottom-up**

**Description:**
Formation of clusters and nanoparticles from supersaturated vapour. Synthesis by chemical routes. Nanostructured materials sol-gel

**Full-or-part-time:** 7h
Theory classes: 7h

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**Rutas de procesamiento: Top-Down**

**Description:**
Rutas de procesamiento: Top-Down

**Full-or-part-time:** 8h
Theory classes: 8h

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**Oral defense and guidance on the monographic work**

**Description:**
Oral defense and guidance of the monographic work

**Full-or-part-time:** 8h 30m
Theory classes: 8h 30m

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**Laboratory sessions**

**Description:**
5 laboratory session on EBSD, metallic glasses, ECAP, Incremental forming, Mechanical Milling

**Full-or-part-time:** 10h
Theory classes: 10h

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**GRADING SYSTEM**

The final mark, $N_{final}$, will be calculated according to the following equation:

$$N_{final} = 0.65N_{ef} + 0.10N_{pract} + 0.25N_{defensa}$$

where $N_{ef}$ is the mark obtained in the final exam, $N_{pract}$ is the laboratory mark and $N_{defensa}$ is the mark of the oral defense of a scientific work

No reevaluation exam will be provided