Course guide
295760 - 295EM115 - Advanced Surface Engineering

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: Spanish

LECTURER

Coordinating lecturer: Gemma Fargas Ribas

Others:

PRIOR SKILLS

Knowledge of materials science and chemistry

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CEMCEAM-03. (ENG) Realizar estudios de caracterización y evaluación de materiales según sus aplicaciones

TEACHING METHODOLOGY

- Face-to-face expository classes (Theory)
- Face-to-face directed classes (Problem solving)
- Cooperative learning.

LEARNING OBJECTIVES OF THE SUBJECT

To understand the goals, benefits and applications of surface engineering.
To acquire a knowledge of the methods and techniques of surface modification from conventional to the most advanced ones and correlate them with the structure and properties achieved on the surface.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours small group</td>
<td>14,0</td>
<td>9.33</td>
</tr>
<tr>
<td>Self study</td>
<td>102,0</td>
<td>68.00</td>
</tr>
<tr>
<td>Hours medium group</td>
<td>28,0</td>
<td>18.67</td>
</tr>
<tr>
<td>Guided activities</td>
<td>6,0</td>
<td>4.00</td>
</tr>
</tbody>
</table>

Total learning time: 150 h
1. Basic concepts of surface engineering

Description:
- Purpose and Need of Surface Engineering
- Classification of Surface Modification Techniques
- Applications and Limitations

Full-or-part-time: 4h
Guided activities: 2h
Self study: 2h

2. Surface engineering by changing the surface metallurgy

Description:
Mechanical methods: Burnishing, Shot peening
Thermal methods: Flame and induction hardening, Laser and electron beam hardening, Plasma and TIG melting

Full-or-part-time: 18h
Guided activities: 8h
Self study: 10h

3. Surface engineering by changing the composition

Description:
- Diffusion-based processes: Carburizing, Nitriding, Cyaniding, Boronizing, Vanadizing
- Ion implantation
- Laser alloying

Full-or-part-time: 24h
Guided activities: 12h
Self study: 12h

4. Surface modification by developing coatings

Description:
- Diffusion-based processes
- Melting-based methods
- Dipping in hot melt-based methods
- Electrolysis-based methods
- Mechanical methods

Full-or-part-time: 30h
Guided activities: 12h
Self study: 18h
5. Multifunctional surface engineering applications

Description:
- Transparent Conductive Oxide Thin Films
- Thin Film Permeation Barriers
- Photocatalytic Thin Films

**Full-or-part-time:** 26h
Guided activities: 6h
Self study: 20h

6. Bio-inspired surfaces and coatings

Description:
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**Full-or-part-time:** 24h
Guided activities: 4h
Self study: 20h

7. Surface engineering of nanomaterials

Description:
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**Full-or-part-time:** 24h
Guided activities: 4h
Self study: 20h

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**GRADING SYSTEM**

First partial test: 15%
Second partial test: 25%
Third partial test: 35%
Autonomous learning: 15%
Laboratory: 10%

In this subject a reassessment test will be scheduled. The students will be able to access the re-assessment test that meets the requirements set by the EEBE in its Assessment and Permanance Regulations (https://eebe.upc.edu/ca/estudis/normatives-academiques/documents/eebe-normativa-avaluacio-i-permanencia-18-19-aprovat-je-2018-06-13.pdf).
# BIBLIOGRAPHY

**Basic:**