Course guides
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).
Academic year: 2020  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
Transversal:
07 AAT. SELF-DIRECTED LEARNING. Detecting gaps in one’s knowledge and overcoming them through critical self-appraisal. Choosing the best path for broadening one’s knowledge.

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>
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<tbody>
<tr>
<td>Hours medium group</td>
<td>28,0</td>
<td>18.67</td>
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<tr>
<td>Hours small group</td>
<td>14,0</td>
<td>9.33</td>
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<tr>
<td>Guided activities</td>
<td>6,0</td>
<td>4.00</td>
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<tr>
<td>Self study</td>
<td>102,0</td>
<td>68.00</td>
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Total learning time: 150 h
## CONTENTS

<table>
<thead>
<tr>
<th>1. Basic concepts of surface engineering</th>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
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<tr>
<td>- Purpose and Need of Surface Engineering</td>
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<tr>
<td>- Classification of Surface Modification Techniques</td>
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<tr>
<td>- Applications and Limitations</td>
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<tr>
<td><strong>Full-or-part-time:</strong> 4h</td>
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<tr>
<td>Guided activities: 2h</td>
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<tr>
<td>Self study : 2h</td>
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<tr>
<th>2. Surface engineering by changing the surface metallurgy</th>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
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<tr>
<td>Mechanical methods: Burnishing y Shot peening</td>
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<tr>
<td>Thermal methods: Flame and induction hardening, Laser and electron beam hardening, Plasma and TIG melting</td>
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<tr>
<td><strong>Full-or-part-time:</strong> 18h</td>
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<tr>
<td>Guided activities: 8h</td>
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<td>Self study : 10h</td>
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<th>3. Surface engineering by changing the composition</th>
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<tbody>
<tr>
<td><strong>Description:</strong></td>
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<tr>
<td>- Diffusion-based processes: Carburizing, Nitriding, Cyaniding, Boronizing, Vanadizing</td>
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<td>- Ion implantation</td>
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<td>- Laser alloying</td>
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<td><strong>Full-or-part-time:</strong> 24h</td>
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<tr>
<td>Guided activities: 12h</td>
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<tr>
<td>Self study : 12h</td>
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<th>4. Surface modification by developing coatings</th>
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<td><strong>Description:</strong></td>
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<tr>
<td>- Diffusion-based processes</td>
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<td>- Melting-based methods</td>
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<td>- Dipping in hot melt-based methods</td>
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<tr>
<td>- Electrolysis-based methods</td>
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<tr>
<td>- Mechanical methods</td>
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<tr>
<td><strong>Full-or-part-time:</strong> 30h</td>
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<tr>
<td>Guided activities: 12h</td>
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<tr>
<td>Self study : 18h</td>
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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:

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

7. Surface engineering of nanomaterials

Description:

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

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 Permanence 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: