240EM115 - Surface Engineering

**Coordination unit:** 295 - EEBE - Barcelona East School of Engineering

**Teaching unit:** 702 - CMEM - Department of Materials Science and Metallurgy

**Academic year:** 2018

**Degree:**
- MASTER'S DEGREE IN MATERIALS SCIENCE AND ENGINEERING (Syllabus 2014).
- ERASMUS MUNDUS MASTER'S DEGREE IN ADVANCED MATERIALS SCIENCE AND ENGINEERING (Syllabus 2009).
- ERASMUS MUNDUS MASTER'S DEGREE IN ADVANCED MATERIALS SCIENCE AND ENGINEERING (Syllabus 2014).
- ERASMUS MUNDUS MASTER'S DEGREE IN ADVANCED MATERIALS SCIENCE AND ENGINEERING (Syllabus 2014).
- MASTER'S DEGREE IN MATERIALS SCIENCE AND ENGINEERING (Syllabus 2014).

**ECTS credits:** 3  

**Teaching languages:** Catalan, Spanish

### Teaching staff

**Coordinator:** JESSICA CALVO MUÑOZ

**Others:** Anna Gironès Molera

### Opening hours

**Timetable:** Fridays, from 17:00 to 18:00h

### Prior skills

Basic physical metallurgy knowledge

### Requirements

Basic physical metallurgy knowledge

### Degree competences to which the subject contributes

**Specific:**
- CEMCEM-02. (ENG) Dissenyar i desenvolupar productes, processos, sistemes i serveis, així com l'optimització d'altres ja desenvolupats, atenent a la selecció de materials per a aplicacions específiques

**Transversal:**
- 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.

### Teaching methodology

This subject consists of a main part dedicated to theoretical lectures. It also has a part related to a continuous evaluation where the students must work on different subjects of their interest related to the course (for example: elaboration of an essay, oral presentations, discussions, reading and discussion of scientific articles, etc)

### Learning objectives of the subject
Surface technology is one of the fields on materials transformations which has experienced a fast evolution. The objective of this subject is allowing students to get familiarized with classical surface treatments, as well as with the modern ones, paying special attention to industrial applications.

### Study load

<table>
<thead>
<tr>
<th>Study load</th>
<th>Total learning time: 75h</th>
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<tbody>
<tr>
<td></td>
<td>Hours large group:</td>
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<tr>
<td></td>
<td>18h</td>
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<td>Hours medium group:</td>
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<td>Hours small group:</td>
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<td>9h</td>
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<td>Guided activities:</td>
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<td>Self study:</td>
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<td>48h</td>
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<td>64.00%</td>
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# Surface Engineering

<table>
<thead>
<tr>
<th>Content</th>
<th>Learning time</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td><strong>Surface engineering introduction</strong></td>
<td>2h</td>
<td><strong>Description:</strong> Main damage mechanisms on industrial samples during service: fatigue, wear and corrosion. Benefits of surface engineering in order to avoid or delay the development of the damage mechanisms.</td>
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</tbody>
</table>
| **Surface modification treatments** | 4h            | **Description:** Surface modification by Physical and Chemical treatments:  
(a) plastic deformation: blasting and shot peening  
(b) thermal surface treatments: flame hardening and induction hardening  
(c) thermochemical surface treatments: carburizing, nitriding, carbonitriding, nitrocarburizing, sulfinization and boronizing. |
| **Non-Metallic coatings**         | 6h            | **Description:** Conversion coatings and their applications:  
(a) phosphating process  
(b) black oxide  
(c) anodizing |
| **Coatings**                     | 1h 30m        | **Description:** Description and coating types, Metallographic and mechanical characterization of coatings, Surface preparation processes to be applied before the coating application. |
### Metallic coatings

**Description:**
- Hot dip coatings:
  - (a) galvanizing, galvanneal, galfan and galvalume
  - (b) aluminium coatings
  - (c) tin coatings

**Learning time:** 5h  
Theory classes: 5h

### Electrochemical coatings

**Description:**
- Electrochemical metal coatings:
  - (a) copper
  - (b) nickel
  - (c) chromium and hard chromium

**Learning time:** 1h 30m  
Theory classes: 1h 30m

### CVD and PVD

**Description:**
- Basics of the CVD (Chemical Vapour Deposition) and PVD (Physical Vapour Deposition) technologies for surface coating deposition.
- Main characteristics and properties of CVD and PVD coatings and their applications.

**Learning time:** 3h  
Theory classes: 3h

### Thermal spraying

**Description:**
- Description of thermal spraying technology for surface coating applications.
- Main properties and characteristics of thermal spray coatings and their applications.

**Learning time:** 2h  
Theory classes: 2h
Qualification system

If NP1>5 and NP2>5 => NF = 0.3* NP1 + 0.4 * NP2 +0.3*NAC 
If NP1<5 or NP2<5 => NF = 0.7*NEF + 0.3*NAC

NP1 = Note mid-term exam 1  
NP2 = Note mid-term exam 2  
NEF = Note final exam 

Re-evaluation: the note obtained in the re-evaluation exam will substitute the "NEF" note in the above formula.

Regulations for carrying out activities

All tasks are compulsory.  
The oral presentation will be done with the support of a powerpoint presentation. Evaluation will be done based on this oral presentation.

Bibliography

Basic:


Complementary: