Course guide
295713 - TESU - Surface Technology

Unit in charge: Barcelona East School of Engineering
Teaching unit: 702 - CEM - Department of Materials Science and Engineering.

Degree: BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Compulsory subject).

Academic year: 2023 ECTS Credits: 6.0 Languages: Catalan

LECTURER
Coordinating lecturer: GEMMA FARGAS RIBAS
Others: Primer quadrimestre:
GEMMA FARGAS RIBAS - Grup: M11, Grup: M12
IGNASI MUNDÓ TIJERAS - Grup: M11, Grup: M12

PRIOR SKILLS
- Basic knowledge of materials science and chemistry

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES
Specific:
CEMT-22. Knowledge and application of materials technology in the production, transformation, processing, selection, control, maintenance, recycling and storage of all types of materials.

Transversal:
07 AAT N2. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.

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

LEARNING OBJECTIVES OF THE SUBJECT
Get to Know analytical techniques and characterization of the surface.
Gaining basic knowledge of surface modification techniques.
Learning to select surface modification techniques based on applications.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Hours small group</td>
<td>15,0</td>
<td>10.00</td>
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<tr>
<td>Guided activities</td>
<td>90,0</td>
<td>60.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>45,0</td>
<td>30.00</td>
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</tbody>
</table>
Total learning time: 150 h

### CONTENTS

#### (ENG) Chapter 1. Introduction

**Description:**
1.1. Surface engineering goals  
1.2. Surface description  
1.3. Surface phenomena: corrosión, wear and fatigue  

**Specific objectives:**
Describe the surface phenomena that limit the useful life of materials and understand the ways that engineering surfaces offers to control and reduce their effects.

**Full-or-part-time:** 5h  
Theory classes: 3h  
Self study: 2h

#### (ENG) Chapter 2. Surface characterization

**Description:**
2.1. Microscopy techniques  
2.2. Spectroscopy techniques  
2.3. Measurements and tests  

**Specific objectives:**
Describe the surface characterization techniques at different scales to determine: microstructure, chemical composition and mechanical properties.

**Full-or-part-time:** 18h  
Theory classes: 7h  
Self study: 11h

#### (ENG) Chapter 3. Surface cleaning:

**Description:**
3.1 Degreasing processes  
3.2 Removal of organic deposits  
3.3 Removal of protective layers  
3.4 Removal of corrosión and oxidation products  

**Specific objectives:**
To understand the importance of cleaning processes prior to surface modification.  
Establish a criterion to select the appropriate cleaning process depending on the initial state of the surface and/or further treatment and/or application.

**Full-or-part-time:** 14h  
Theory classes: 5h  
Self study: 9h
**Chapter 4. Surface modification without changing the material chemically**

**Description:**
4.1. Thermal treatments: Quenching and annealing  
4.2. Mechanical treatments: Shot peening

**Specific objectives:**
Understand basic theory of these processes  
Describe the stages on which these processes are carried out at industrial level  
Understand their effect on the surface regarding microstructure and mechanical properties  
Know under which work conditions these processes are useful

**Related activities:**
Presentation of case studies

**Full-or-part-time:** 12h  
Theory classes: 7h  
Self study: 5h

**Chapter 5. Surface modification by altering surface chemistry**

**Description:**
5.1. Carburization  
5.2. Nitraturation  
5.3. Passivation  
5.4. Phosphatation  
5.5. Ionic implantation

**Specific objectives:**
1. Understand basic theory of these processes  
2. Describe the stages on which these processes are carried out at industrial level  
3. Understand their effect on the surface regarding microstructure and mechanical properties  
4. Know under which work conditions these processes are useful

**Related activities:**
Presentation of case studies

**Full-or-part-time:** 21h  
Theory classes: 12h  
Self study: 9h
Chapter 6. Surface modification by adding a new material onto the surface (coating). Conventional techniques

**Description:**
6.1. Introduction to coatings
6.2. Electroplating
6.3. Electroless
6.4. Galvanized

**Specific objectives:**
Understand basic theory of these processes
Describe the stages on which these processes are carried out at industrial level
Understand their effect on the surface regarding microstructure and mechanical properties
Know under which work conditions these processes are useful

**Related activities:**
Presentation of case studies

**Full-or-part-time:** 21h
Theory classes: 11h
Self study: 10h

Chapter 7. Surface modification by adding a new material onto the surface (coating). Advanced techniques

**Description:**
7.1. Thermal spray
7.2. Chemical vapor deposition
7.3. Physical vapor deposition

**Specific objectives:**
Understand basic theory of these processes
Describe the stages on which these processes are carried out at industrial level
Understand their effect on the surface regarding microstructure and mechanical properties
Know under which work conditions these processes are useful

**Related activities:**
Presentation of case studies

**Full-or-part-time:** 16h
Theory classes: 7h
Self study: 9h
(ENG) Chapter 8. Surface modification by adding a new material onto the surface (coating): Organic coatings

Description:
8.1. Technology and functions
8.2. Types and selection criteria
8.3. Application processes
8.4. Pathological processes

Specific objectives:
Understand basic theory of these processes
Describe the stages on which these processes are carried out at industrial level
Understand their effect on the surface regarding microstructure and mechanical properties
Know under which work conditions these processes are useful

Related activities:
Presentation of case studies

Full-or-part-time: 16h
Theory classes: 6h
Self study: 10h

Chapter 9. Nanotechnology in surfaces

Description:
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Specific objectives:
Understand basic theory of these processes
Describe the stages on which these processes are carried out at industrial level
Understand their effect on the surface regarding microstructure and mechanical properties
Know under which work conditions these processes are useful

Full-or-part-time: 7h
Theory classes: 2h
Self study: 5h

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:

Complementary: