Course guide
295713 - TESU - Surface Technology

Last modified: 04/06/2026

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: 2026 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: GEMMA FARGAS RIBAS

Others: Primer quadrimestre:
GEMMA FARGAS RIBAS - Grup: M11, Grup: M12
GISELLE RAMÍREZ SANDOVAL - 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

Type	Hours	Percentage
Self study	90,0	60.00
Hours small group	10,0	6.67
Hours large group	50,0	33.33

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

(ENG) 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 therory 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

(ENG) Chapter 5. Surface modification by altering surface chemistry

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

Specific objectives:
1-Understand basic therory 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

(ENG) 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 therory 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

(ENG) 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 depositio

Specific objectives:
Understand basic therory 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. Aplication processes
8.4. Phatological processes

Specific objectives:
Understand basic therory 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 therory 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

Any academic fraud, plagiarism or use or possession of unauthorised means in an assessment activity leads to a mark of zero (0) for the affected test or assignment. Furthermore, in accordance with the University's regulations, if disciplinary proceedings are initiated the subject is recorded as "Pending Assessment" until a decision is reached. These incidents are managed in accordance with the **Action Framework for Academic Integrity in Assessment at the UPC**.

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:
- Puértolas Ráfales, José Antonio [et al.]. Tecnología de superficies en materiales. Madrid: Síntesis, 2010. ISBN 9788497566803.
- Vázquez Vaamonde, Alfonso J.; Damborenea González, Juan J. de. Ciencia e ingeniería de la superficie de los materiales metálicos. Madrid: Consejo Superior de Investigaciones Científicas, 2000. ISBN 8400079205.
- Davis, J. R.. Surface engineering : for corrosion and wear resistance. ASM International, 2001. ISBN 0871707004.

Complementary:
- Martin, P. M. Introduction to surface engineering and functionally engineered materials [on line]. Salem, Mass: Scrivener Publishing LLC, 2011 [Consultation: 17/06/2020]. Available on: https://onlinelibrary.wiley.com/doi/book/10.1002/9781118171899. ISBN 9780470639276.
- Burnell-Gray, J. S.; Datta P. K.. Surface engineering casebook. Woodhead Publishing, Ltd. Abington Hall, 1996. ISBN 9781855732605.
- Adamson, A. W.; Gast A. P.. Physical chemistry of surfaces. 6th ed. John Wiley & Sons, 1997. ISBN 9780471148739.