UNIVERSITAT POLITĖCNICA
DE CATALUNYA
BARCELONATECH

## Course guide

## 820465 - ESU - Engineeriing Surfaces

Unit in charge:
Teaching unit:

Degree:
Languages: Catalan

Barcelona East School of Engineering
702 - CEM - Department of Materials Science and Engineering.

Academic year: 2024 ECTS Credits: 6.0

LECTURER

Coordinating lecturer:

Others:

MIQUEL MORALES COMAS
Segon quadrimestre:
GEMMA FARGAS RIBAS - M10
MIGUEL MORALES COMAS - M10

## PRIOR SKILLS

Basic knowledge of materials science and chemistry.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES
Transversal:

1. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

## TEACHING METHODOLOGY

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

## LEARNING OBJECTIVES OF THE SUBJECT

1- Get to Know analytical techniques and characterization of the surface.
2- Gaining basic knowledge of surface modification techniques.
3- Learning to select surface modification techniques based on applications.

## STUDY LOAD

| Type | Hours | Percentage |
| :--- | :--- | :--- |
| Self study | 90,0 | 60.00 |
| Hours large group | 60,0 | 40.00 |

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.

## Related activities:

Presentation of case studies
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: 14 h

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: 12 h
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: 21 h
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

## Related activities:

Presentation of case studies
Full-or-part-time: 21h
Theory classes: 11 h
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 deposition

## Related activities:

Presentation of case studies
Full-or-part-time: 16 h
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

## Related activities:

Presentation of case studies
Full-or-part-time: 16 h
Theory classes: 6h
Self study : 10h

## Chapter 9. Nanotechnology in surfaces

## Description:

9.1. Pulsed laser deposition
9.2. Litography

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\%
Work: 15\%
Laboratory: 10\%

In this subject a reassessment test will be scheduled

## EXAMINATION RULES.

Autonomous learning evaluation: report and oral presentation

## BIBLIOGRAPHY

## Basic:

- J. A. Puértolas Ráfales, R. Ríos Jordana, M. Castro Corella, J. M. Casals Bustos. Tecnología de superficies en materiales. Madrid: Síntesis, D.L. 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. Materials Park: ASM International, cop. 2001. ISBN 0871707004.


## Complementary:

- Martin, Peter M. Introduction to surface engineering and functionally engineered materials. Hoboken, N.J: Wiley, 2011. ISBN 9781118171899.
- Burnell-Gray, J.S.; Datta, P.K. Surface engineering casebook. Abington (Cambridge): Woodhead Publishing, Ltd. Abington Hall, 1996. ISBN 1855732602.
- Adamson, Arthur W. Physical chemistry of surfaces. 6th ed. New York [etc.]: John Wiley \& Sons, 1997. ISBN 9780471148739.

