



## Course guide

### 295760 - 295EM115 - Advanced Surface Engineering

Last modified: 02/10/2025

**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).  
ERASMUS MUNDUS MASTER'S DEGREE IN ADVANCED MATERIALS SCIENCE AND ENGINEERING (Syllabus 2021). (Optional subject).

**Academic year:** 2025    **ECTS Credits:** 6.0    **Languages:** Spanish

#### LECTURER

**Coordinating lecturer:** GEMMA FARGAS RIBAS

**Others:** Primer quadrimestre:  
GEMMA FARGAS RIBAS - Grup: T1  
JAUME PUJANTE AGUDO - Grup: T1  
GISELLE RAMIREZ SANDOVAL - Grup: T1

#### PRIOR SKILLS

Knowledge of materials science and chemistry

#### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

**Specific:**  
CEMCEAM-03. (ENG) Realizar estudios de caracterización y evaluación de materiales según sus aplicaciones

#### 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

Type	Hours	Percentage
Self study	108,0	72.00
Hours large group	28,0	18.67
Hours small group	14,0	9.33



Total learning time: 150 h

## CONTENTS

### 1. Basic concepts of surface engineering

**Description:**

- Purpose and Need of Surface Engineering
- Classification of Surface Modification Techniques
- Applications and Limitations

**Full-or-part-time:** 4h

Guided activities: 2h

Self study : 2h

### 2. Surface engineering by changing the surface metallurgy

**Description:**

Mechanical methods: Burnishing y Shot peening

Thermal methods: Flame and induction hardening, Laser and electron beam hardening, Plasma and TIG melting

**Full-or-part-time:** 18h

Guided activities: 8h

Self study : 10h

### 3. Surface engineering by changing the composition

**Description:**

- Diffusion-based processes: Carburizing, Nitriding, Cyaniding, Boronizing, Vanadizing
- Ion implantation
- Laser alloying

**Full-or-part-time:** 24h

Guided activities: 12h

Self study : 12h

### 4. Surface modification by developing coatings

**Description:**

- Diffusion-based processes
- Melting-based methods
- Dipping in hot melt-based methods
- Electrolysis-based methods
- Mechanical methods

**Full-or-part-time:** 30h

Guided activities: 12h

Self study : 18h



### 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:**

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**Full-or-part-time:** 24h

Guided activities: 4h

Self study : 20h

### 7. Surface engineering of nanomaterials

**Description:**

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**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

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### Basic:

- Dwivedi, Dheerendra Kumar. Surface Engineering : Enhancing Life of Tribological Components [on line]. New Delhi: Springer India, 2018 [Consultation: 06/10/2020]. Available on: <https://doi.org/10.1007/978-81-322-3779-2>. ISBN 9788132237792.
- Tiwari, Ashutosh; Wang, Rui; Wei, Bingqing. Advanced surface engineering materials [on line]. Beverly: Scrivener Publishing, cop. 2016 [Consultation: 06/10/2020]. Available on: <https://onlinelibrary.wiley.com/doi/book/10.1002/9781119314196>. ISBN 9781119314158.
- Chattopadhyay, Ramnarayan. Advance thermally assisted surface engineering processes. Springer Science, 2004. ISBN 9781402077647.
- Burnell-Gray, J. S.; Datta, P. K. Surface engineering casebook : solutions to corrosion and wear-related failures. Abington (Cambridge): Woodhead Publishing, 1996. ISBN 1855732602.
- Martin, Peter M. Introduction to surface engineering and functionally engineered materials [on line]. Salem, Mass.: Scrivener Pub., 2011 [Consultation: 06/10/2020]. Available on: <https://onlinelibrary.wiley.com/doi/book/10.1002/9781118171899>. ISBN 9781118171899.
- Adamson, Arthur W.. Physical chemistry of surfaces. 6th ed. New York [etc.]: John Wiley & Sons, 1997. ISBN 9780471148739.
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