

Course guide

240EM115 - 240EM115 - Surface Engineering

Last modified: 26/06/2025

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

Degree: ERASMUS MUNDUS MASTER'S DEGREE IN ADVANCED MATERIALS SCIENCE AND ENGINEERING (Syllabus 2014). (Optional subject).

Academic year: 2025 **ECTS Credits:** 3.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: JESSICA CALVO MUÑOZ

Others: Anna Gironès Molera

PRIOR SKILLS

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

Subject in process of extinction. There is no teaching, the students that enroll it do so only with the right to an exam.

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

Type	Hours	Percentage
Hours small group	9,0	12.00
Self study	48,0	64.00
Hours large group	18,0	24.00

Total learning time: 75 h

CONTENTS

Surface engineering introduction

Description:

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.

Full-or-part-time: 2h

Theory classes: 2h

Surface modification treatments

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, sulfination and boronizing.

Full-or-part-time: 4h

Practical classes: 4h

Non-Metallic coatings

Description:

Conversion coatings and their applications:

- (a) phosphating process
- (b) black oxide
- (c) anodizing

Full-or-part-time: 6h

Theory classes: 6h

Coatings

Description:

Description and coating types.
Metallographic and mechanical characterization of coatings.
Surface preparation processes to be applied before the coating application.

Full-or-part-time: 1h 30m

Theory classes: 1h 30m

Metallic coatings

Description:

Hot dip coatings:

- (a) galvanizing, galvalume, galfan and galvalume
- (b) aluminium coatings
- (c) tin coatings

Full-or-part-time: 5h

Theory classes: 5h

electrochemical coatings

Description:

Electrochemical metal coatings:

- (a) copper
- (b) nickel
- (c) chromium and hard chromium

Full-or-part-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.

Full-or-part-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.

Full-or-part-time: 2h

Theory classes: 2h

GRADING SYSTEM

Subject in process of extinction. There is only one final test that corresponds to 100% of the final grade of the subject.

BIBLIOGRAPHY

Basic:

- Ciencia e ingeniería de la superficie de los materiales metálicos. Madrid: CSIC Press, 2001. ISBN 8400079205.
- Tecnología de superficies en materiales. Madrid: Síntesis, DL 2010. ISBN 9788497566803.
- Surface engineering : for corrosion and wear resistance. ASM International, cop. 2001. ISBN 0871707004.

Complementary:

- Martin, Peter M. Introduction to surface engineering and functionally engineered materials [on line]. Hoboken, N. J: Wiley, 2011 [Consultation: 20/05/2020]. Available on: <https://onlinelibrary.wiley.com/doi/book/10.1002/9781118171899>. ISBN 9781118171899.