GENERAL CHARACTERISTICS*

Type: ☐Basic formation, ☐Compulsory, ☑Optional
☐Master Thesis, ☐External practices

Duration: Semester **Semester / s**: 2
Number of ECTS credits: 4
Languages: Spanish, Catalan, English

DESCRIPTION

BRIEF DESCRIPTION AND JUSTIFICATION

The subject of Surface Engineering aims to introduce students to the field of surfaces-related phenomena. It provides an overview of surface modification techniques that allow changing their properties, such as protection in harsh or chemically aggressive environments, reduction of friction, increased hardness to minimize wear or modification of electrical conductivity.
The subject uses the knowledge acquired in subjects of previous studies of the industrial branch.

COMPETENCES

- E21 - Have useful complementary knowledge, including theoretical and practical aspects, for the practice of Science and Materials Engineering.
- E22 – Ability to recognize disciplines related or somehow related to the practice of Material Science and Engineering that will be useful for the development of their professional practice.
- CG2 - The ability to perform a responsible practice of the profession.
- CB6 - To have and understand the required knowledge that provides the basis or opportunity to be innovative in the development and/or application of ideas, often in a research context.
- CB7 - To apply their knowledge and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study
- CB8 - To integrate knowledge and deal with the complexity of formulating judgments based on information, which, being incomplete or limited, includes reflections on social and ethical responsibilities related to the application of their knowledge and judgments.
- CB9 - To communicate conclusions and the reasons that sustain them, to specialized and non-specialized audiences in a clear and unambiguous way

PREREQUISITES*
The corresponding to access master studies

CONTENTS

1. Introduction. Interfaces: solid-gas, solid-liquid, etc. Vacuum science and technology. Thermodynamics of surfaces and materials. Adsorption of gases. Kinetics. Nucleation

2. Phenomena related to surfaces: Friction. Wear. Corrosion.

3. Surface Engineering Techniques (I). Galvanic and chemical coatings (electroless). Chemical conversion Hot dip Surface thermal treatments. Treatments for superficial plastic deformation. Surface finishing. Sol-Gel.

4. Surface Engineering Techniques (II): vacuum or controlled atmospheres. Thermochemical treatments. Cementation Pack. Chemical Vapor Deposition (CVD). Physical Vapor Deposition (PVD). Thermal or plasma spray.

5. Case study: ceramic coatings for increased hardness, reduction of wear and friction, prevention of corrosion, decorative coatings, biomaterials, etc.

METHODOLOGY

LEARNING ACTIVITIES *

Learning Activities	ECTS credits	Competences
Lectures	1.15	E21, E22, CB6, CB7
Seminars	0.07	E21, E22, CB7, CB8, CB9
Case and Problem-Solving Sessions	0.15	E21, E22, CB6, CB7
Personal study	2,33	E21, E22, CB6, CB7, CB8
Presentations	0.15	E21, E22, CG2
Assessment Tasks (Exams, Continuous Assessment...)	0.15	E21, E22, CG2,CB9
TOTAL	**4**	

TEACHING METHODOLOGY

The teaching methodology used in the course is based on lectures and case and problem-solving sessions. Seminars are also scheduled to solve doubts.

The lectures and problem solving classes are linked to dynamic-explanatory classes (content presentation), dynamic-demonstrative classes (the teacher solves a problem) and dynamic-active classes (the student solves the problem).
The student is provided with the complete course documentation with theory and case documents for personal study. In addition, complementary exercises to the course bibliography are recommended.

ASSESSMENT

ASSESSMENT METHODS *

Assessment methods	Weight	Competences
Final exam	40%	E21, E22, CB6, CB7
Reports and Presentations	15%	E21, E22, CG2, CB8, CB9
Follow-up activities	40%	E21, E22, CB6, CB7
Participation	5%	CG2

LEARNING OUTCOMES

- The students have to demonstrate they know the systems of modification of the surface of materials (CB6, CB7, CG2, E21)
- Students must be able to select techniques for modifying material surfaces in order to improve their properties and design functional coating-substrate systems from the industrial point of view (CB8, CB9, T2, E22)

QUALIFICATION

The evaluation of the course will consider all aspects listed in the evaluation table with its corresponding weight. The main weight of the grade lies in the final examination (40%). In addition, the results of the 2 scheduled follow-up activities (20% + 20%), the participation activities carried out in class 5%, and the evaluable works that will be carried out individually 15% are included in the final grade.

ASSESSMENT OF THE COMPETENCES (Define calculation expressions for each competency based assessment activities related.)

The grade of the final exam, reports and presentations and follow-up activities will be used as an indicator for the evaluation of E21 and E22 competences.

The grades of participation, reports and presentations and follow-up activities will be used as an indicator for the assessment of competence CG2.

The grade of the final exam and follow up activities will be used as an indicator for the assessment of CB6, CB7 competences.

* These features should not be modified without the approval of the bodies responsible for academic higher-level structures (field, module and / or system).

The grade of the reports and presentations will be used as an indicator for the assessment of CB8, CB9 competences.

BIBLIOGRAPHY (Recommended and accessible to students.)

1. Surface Engineering Casebook (Solutions to corrosion and wear-related failures), Eds. J.S. Burnell-Gray and P.K.Datta, Woodhead Publishing Limited, 1996, Cambridge (England). ISBN 1-85573-260-2.
2. Surface Engineering for Corrosion and Wear Resistance, Ed. J.R.Davis, ASM International, 2001, Ohio (USA). ISBN 0-87170-700-4.
3. Materials Science of Thin Films 2nd Ed., Milton Ohring, Academic Press, 2002, San Diego (USA). ISBN 0-12-524975-6.
4. Surface Engineering, ASM Handbook vol. 5, Ohio (USA). ISBN 0-87170-384-X.

DOCUMENT HISTORY

PREVIOUS CHANGES
March 24, 2015, Dr. Carles Colominas
July 20, 2014, Dr. Carles Colominas

CURRENT REVISION
March 16, 2019, Dr. Carles Colominas