Surface Engineering

Academic Year: (2023 / 2024) **Review date: 18-04-2023**

Department assigned to the subject: Materials Science and Engineering and Chemical Engineering Department

Coordinating teacher: BAUTISTA ARIJA, MARIA ASUNCION

Type: Electives ECTS Credits : 3.0

Year : 4 Semester :

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Technology of Materials

SKILLS AND LEARNING OUTCOMES

CB1. Students have demonstrated possession and understanding of knowledge in an area of study that builds on the foundation of general secondary education, and is usually at a level that, while relying on advanced textbooks, also includes some aspects that involve knowledge from the cutting edge of their field of study
CB2. Students are able to apply their knowledge to their work or vocation in a professional manner and possess the competences usually demonstrated through the development and defence of arguments and problem solving within their field of study.
CB3. Students have the ability to gather and interpret relevant data (usually within their field of study) in order to make judgements which include reflection on relevant social, scientific or ethical issues.
CB5. Students will have developed the learning skills necessary to undertake further study with a high degree of autonomy.
CG1. Ability to solve problems with initiative, decision-making, creativity, critical reasoning and to communicate and transmit knowledge, skills and abilities in the field of Industrial Engineering.
CG3. Ability to design a system, component or process in the field of Industrial Technologies to meet the required specifications
CG4. Knowledge and ability to apply current legislation as well as the specifications, regulations and mandatory standards in the field of Industrial Engineering.
CG5. Adequate knowledge of the concept of company, institutional and legal framework of the company. Organisation and management of companies.
CG6. Applied knowledge of company organisation.
CG8. Knowledge and ability to apply quality principles and methods.
CG9. Knowledge and ability to apply computational and experimental tools for the analysis and quantification of Industrial Engineering problems.
RA1. Knowledge and understanding: Have basic knowledge and understanding of science, mathematics and engineering within the industrial field, as well as knowledge and understanding of Mechanics, Solid and Structural Mechanics, Thermal Engineering, Fluid Mechanics, Production Systems, Electronics and Automation, Industrial Organisation and Electrical Engineering.
RA2. Engineering Analysis: To be able to identify engineering problems within the industrial field, recognise specifications, establish different resolution methods and select the most appropriate one for their solution
RA3. Engineering Design: To be able to design industrial products that comply with the required specifications, collaborating with professionals in related technologies within multidisciplinary teams.
RA4. Research and Innovation: To be able to use appropriate methods to carry out research and make innovative contributions in the field of Industrial Engineering.
RA5. Engineering Applications: To be able to apply their knowledge and understanding to solve problems and design devices or processes in the field of industrial engineering in accordance with criteria of cost, quality, safety, efficiency and respect for the environment.
RA6. Transversal Skills: To have the necessary skills for the practice of engineering in today's society.

OBJECTIVES

- Knowledge about the basic mechanism of electrochemical deterioration of surfaces: aqueous corrosion and corrosion in hot gases.
- Ability to interpret the results of the most common corrosion tests.
- Knowledge about the advantages and limitations of the techniques and technologies most used to protect the surfaces and improve their properties.

DESCRIPTION OF CONTENTS: PROGRAMME

Surface Engineering Course 23/24

Topic 1: Corrosion cells and importance of oxides
Topic 2: Corrosion in hot gases
Topic 3: Materials for corrosive conditions
Topic 4: Thermodynamics of aqueous corrosion
Topic 5: Generalized corrosion and distribution of anodes
Topic 6: Localized corrosion and assisted by physical efforts
Topic 7: Corrosion tests
Topic 8: Aqueous corrosion evaluation methods
Topic 9: Types of coatings
Topic 10: Surface preparation
Topic 11: Metallic coatings by immersion
Topic 12: Metallic coatings by electrodeposition
Topic 13: Metallic coatings by chemical deposition
Topic 14: Conversion coatings
Topic 15: Thermal Spray Coatings
Topic 16: Deposition of thin layers: PVD and CVD

LEARNING ACTIVITIES AND METHODOLOGY

Throughout the fourteen weeks of class, six evaluable exercises will be proposed that students must solve to delve into the content taught during the face-to-face sessions. Students will have 7 days to solve the exercises. These will be published in Aula Global immediately after the delivery of the following face-to-face sessions:
- Exercise 1: session 2
- Exercise 2: session 4
- Exercise 3: session 7
- Exercise 4: session 9
- Exercise 5: session 10
- Exercise 6: session 13

Students must attend two laboratory sessions, obtain the experimental data and complete the corresponding scripts in small groups. The laboratory sessions will have to arrive within the class schedule and on the following dates
- Session 12: April 23th
- Session 13 - April 30th

There will be three multiple choice questionnaires during the classes. The questionnaires will be face-to-face, in the classroom, at the beginning of the session.

Students may request by email all those tutorials (individual or in small groups) that they believe are necessary to properly assimilate the concepts taught in class.

ASSESSMENT SYSTEM

-10% laboratory practices (with resolution in small groups of the questions raised in the scripts).
- 20% 6 evaluable exercises (to be solved individually or in pairs). There will be 2 exercises per thematic block.
- 30% 3 multiple choice questionnaires carried out during the course and referring to three different thematic blocks.
- 40% final exam
Those students with more than 6.5 in one of the three blocks (60% mark of the questionnaire + 40% mark of the 2 exercises of the block) may choose to release that part of the final exam, keeping that grade for also 1/3 of the final evaluation.

Those students who, with the continuous assessment grade and two RELEASE parts of the final exam with a good grade and counting the other as 0 in the corresponding third of the final exam, achieve a pass can also release the subject.

% end-of-term-examination:	40
% of continuous assessment (assigments, laboratory, practicals…):	60

BASIC BIBLIOGRAPHY

- E. Otero Huerta Corrosión y Degradación de Materiales, Sintesis.

- J.A Gonzalez Fernández Control de la corrosión. Estudio y medida por técnicas electroquímicas, CSIC.
- J.L. Puertolas y otros Tecnología de superficies de materiales, Sintesis.
- Varios Friction, lubrication and wear. ASM Handbook Vol. 18, ASM.

ADDITIONAL BIBLIOGRAPHY

- A. Foresgren Corrosion control through organic coatings, CCR/Taylor and Francis.
- M.G. Fontana Corrosion engineering, McGraw-Hill international.
- R. Baboian Corrosion tests and standards: application and interpretation , ASM.
- R.A. Cottis Sheirs Corrosion, Elsevier.
- Varios Corrosion. ASM Handbook Vol. 13, ASM.