

Academic Year: (2019 / 2020)

Review date: 20/04/2020 20:05:38

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

OBJECTIVES

By the end of this subject, students will be able to have:

1. a systematic understanding of the key aspects and concepts of surface engineering
2. coherent knowledge of surface engineering including some at the forefront of the branch in mechanical engineering;
3. awareness of the wider multidisciplinary context of engineering.
4. the ability to apply their knowledge and understanding to identify, formulate and solve problems of surface engineering using established methods;
5. an understanding of methodologies in corrosion and wear of surfaces and an ability to use them.
6. the ability to design and conduct appropriate experiments of corrosion and wear testing and coating of surfaces, interpret the data and draw conclusions.
7. workshop and laboratory skills in surface engineering.
8. demonstrate awareness of the health, safety and legal issues and responsibilities of engineering practice, the impact of engineering solutions in a societal and environmental context, and commit to professional ethics, responsibilities and norms of engineering practice;

DESCRIPTION OF CONTENTS: PROGRAMME

1. TRIBOLOGY
 - 1.1 Erosion and wear mechanism
 - 1.2 Evaluation of the wear
 - 1.3 Lubrication
2. HIGH TEMPERATURA CORROSION
 - 2.1 Thermodynamics aspects
 - 2.2 Selective corrosion of alloys
 - 2.3. Kinetics aspects
3. CORROSION ACUOSA
 - 3.1 Thermodynamics aspects
 - 3.2 Mechanisms y kinetic of general and galvanic corrosion
 - 3.3 Types of localized corrosion. Probabilistic studies.
 - 3.4 Types of corrosion determined by metallurgical aspects.
 - 3.5 Accelerated tests in chambers and their evaluation.
4. PROTECTION METHODS AGAINTS CORROSION
 - 4.1 Modification of the environment: corrosion inhibitors.
 - 4.2 Cathodic protection.
 - 4.3 Anodic protection
5. SURFACE PRETREATMENT AND TYPES OF COATINGS

- 5.1 Mechanical pretreatment
- 5.2 Degreasing pretreatment
- 5.3 Acid picking.
- 5.4 Types of coatings. Classification of the coatings by their anticorrosion mechanism

6. METALLIC COATINGS

- 6.1 Immersion coatings
- 6.2 Electroplated coatings
- 6.3 Electroless coatings

7. ORGANIC COATINGS

- 7.1 Painting methods
- 7.2 Types of organic coatings

8. CERAMIC COATINGS

- 8.1 Conversion coating: chemical process and anodization
- 8.2 PVD and CVD process
- 8.3 Thermal spray coatings.

LEARNING ACTIVITIES AND METHODOLOGY

During the lectures, the main concepts will be explained and the students will delve into them through short oral questions they should be able to reason out.

During the fourteen weeks the lectures last, eight assessment exercises will be raised to the students to be individually solved with the aim of going more deeply into the contents taught during the lectures.

Students should attend to two lab sessions, obtain the required experimental data and solve in small groups the raised questions. The lab session will have the following contents.

- session 1: Corrosion
- session 2: Coatings

ASSESSMENT SYSTEM

% end-of-term-examination/test:	40
% of continuous assessment (assignments, laboratory, practicals...):	60
- 40%: final exam.	
- 20%: attendance to the lab practices and answering to the raised questions	
- 10%: answering to the questions raised during the lectures.	
- 30%: individual exercises.	

BASIC BIBLIOGRAPHY

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