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

Corrosion is a problem faced by some industrial elements, especially those that transport fluids. This course raises the different types of corrosion, analyzing the causes that produce them, listing the precautions to avoid them and the remedies to correct them. It will also explain the different techniques that allow to evaluate the scope of corrosion both at the laboratory scale and at the industrial scale.

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.
Definition of corrosion. Incidence of corrosion in industrial processes. Economic importance. The Hoar Report. Bibliography.
2. Basic electrochemistry.
Thermodynamic aspect of corrosion. Kinetic appearance of corrosion
3. Different types of wet corrosion.
Generalized corrosion. Galvanic corrosion. Crevice Corrosion. Pitting corrosion. Stress corrosion. Bacteriological corrosion. Study of the characteristics that the phenomenon presents in each case, causes that produce it and ways to combat it.
4. Atmospheric corrosion.
Influence of environmental humidity and contamination: attempts to quantify these parameters. Plotting corrosivity maps
5. High-temperature corrosion.
Study of the different corrosion kinetics at high temperature. Phenomena of passivation by different types of oxides. Decarburization of steels.
6. Control systems and prevention of corrosion.
Laboratory scale systems. Industrial scale systems. Criteria for selecting a corrosion control system. Proper materials selection. Influence of the design. Action of inhibitors. Anodic and cathodic protection. Coatings.
7. Materials selection.
Description of the main metallic and non-metallic materials used in the industry: mechanical and chemical properties; applications and price. More detailed study of stainless steels and high performance alloys.
8. Discussion of real cases.
Diagnose the causes of the problem and point out possible solutions

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

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

TOTAL	**4**	

TEACHING METHODOLOGY

In the **lectures**, the concepts included in the program are presented, using the classical techniques: chalk-blackboard and projections. In some classes, classroom experiments are interspersed that facilitate the understanding of some concepts and favor the participation of the students. Dynamic classes are encouraged in which the question-answer game can benefit not only the student who has asked the question, but also their classmates.

Case and Problem-Solving Sessions: There are collections of cases of corrosion, which are delivered to students throughout the course. Students must plan chemical analyses and other tests to arrive at a diagnosis and suggest improvements. With this activities we try to help the student to understand, deepen and relate the concepts studied in the lectures. In class, examples, which present greater difficulties for the students, are solved.

Individual and group consultations in the professor's office: Students can make their queries to the professor individually or in groups of two to five people

ASSESSMENT

ASSESSMENT METHODS *

Assessment methods	Weight	Competences
Final exam	40%	E21, E22, CB6
Reports and Presentations	20%	E21, E22, CB8, CB9, CB10, T1
Follow-up activities	30%	E21, E22, CB6
Participation	10%	CG2

LEARNING OUTCOMES

• The student must be able to identify and understand different mechanisms of corrosion and oxidation. (E22)
• The student must know and know how to use modern techniques for the evaluation of corrosion phenomena, both in research and at the industrial level. (E21)
• The student must be able to choose different methods of protection against corrosion, according to the corrosion mechanisms. (E21, E22, CG2, T1)

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%). The

reports and presentations include presentations in class and specific monographic works that are requested to the student (20%). Follow-up activities include midterm exams or other deliverables (30%). The participation (10%) includes attitude, assistance and initiative shown by the student in the subject.

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 grade of participation 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 competence.

The grade of the reports and presentations will be used as an indicator for the assessment of CB7, CB8, CB9 competences.

BIBLIOGRAPHY (Recommended and accessible to students.)

- Mars G. Fontana. Corrosion Engineering. Ed. McGraw Hill (1980)
- Pierre Roberge. Handbook of Corrosion Engineering. Ed. McGraw Hill (2012)

DOCUMENT HISTORY

PREVIOUS CHANGES
July 21, 2016, Dr. Sergi Colominas
July 20, 2015, Dr. Sergi Colominas

CURRENT REVISION
March 16, 2019, Dr. Sergi Colominas