Course guide
295712 - DCD - Wear, Corrosion and Degradation

Last modified: 03/03/2026

Unit in charge: Barcelona East School of Engineering
Teaching unit: 713 - EQ - Department of Chemical Engineering.
702 - CEM - Department of Materials Science and Engineering.

Degree: BACHELOR'S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Compulsory subject).

Academic year: 2025 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: JOSE IGNACIO IRIBARREN LACO

Others: Segon quadrimestre:
FERHUN CEM CANER BASKURT - Grup: M11, Grup: M12
NÚRIA CINCA I LUIS - Grup: M11, Grup: M12
JOSE IGNACIO IRIBARREN LACO - Grup: M11, Grup: M12
GISELLE RAMÍREZ SANDOVAL - Grup: M11, Grup: M12
JORDI SANS MILÀ - Grup: M11, Grup: M12

PRIOR SKILLS

Basic knowledge in Chemistry and Materials

REQUIREMENTS

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CEMT-20. Knowledge of the mechanical, electronic, chemical and biological behaviour of materials, and the ability to apply it in designing, calculating and modelling aspects of elements, components and equipment.

CEMT-24. Knowledge of and the capacity for the evaluation of the safety, durability and structural integrity of materials and components that are manufactured with these materials.

Transversal:
06 URI N3. EFFECTIVE USE OF INFORMATI0N RESOURCES - Level 3. Planning and using the information necessary for an academic assignment (a final thesis, for example) based on a critical appraisal of the information resources used.
05 TEQ N3. TEAMWORK - Level 3. Managing and making work groups effective. Resolving possible conflicts, valuing working with others, assessing the effectiveness of a team and presenting the final results.

TEACHING METHODOLOGY

Two methodologies will be applied during the lessons:
a) Expositive method by using the material avalaible in plataform Atenea
b) Exercices resolution in groups formed by 3-4 students by means cooperative work in classroom. Individual evaluation will be carried out at the end of the sesion.
c) Coopertative learning

LEARNING OBJECTIVES OF THE SUBJECT

Tha main objective is to prepare specialists technics in corrosion in order to avoid the economics loss in public and privates enterprises.
Specific objectives:
Know the thermodynamic and kinetics basis of the corrosion.
Anticipate the corrosion and apply the
Study and diagnose differents types of corrosion.
Select suitably the corrosion resistent materials.
Corrosion prevention and protection solutions.
Know the basic fundamental of wear, degradation and corrosion.
Study and diagnose differents types of wear, degradation and corrosion

STUDY LOAD

Type	Hours	Percentage
Hours large group	50,0	33.33
Self study	90,0	60.00
Hours small group	10,0	6.67

Total learning time: 150 h

CONTENTS

1. Introduction. Corrosion basics. Thermodynamic aspects. Nernst equation

Full-or-part-time: 6h
Theory classes: 2h
Practical classes: 2h
Self study : 2h

2. Pourbaix diagrams obtention. Applications.

Full-or-part-time: 6h
Theory classes: 2h
Practical classes: 2h
Self study : 2h

3. Corrosion kinetics. Activation polarization. Tafel equation and Evans diagrams. Concentration and resistance polarization. Pasivation. Flade potential.

Full-or-part-time: 6h
Theory classes: 2h
Practical classes: 2h
Self study : 2h

4. Types of corrosion. Environmental, water, soil, microbiological and marine corrosion. Galvanic, uniform, located, intergranular and stress corrosion cracking.

Full-or-part-time: 6h
Theory classes: 2h
Practical classes: 2h
Self study : 2h

5. Cathodic protection. Protection by sacrificial anodes. Characteristics of the sacrificial anodes. Anodes number calculation and their probable life. Protection by impressed current. Applications.

Full-or-part-time: 4h
Theory classes: 1h
Practical classes: 1h
Self study : 2h

6. Anticorrosive coatings. Electrolytic metallic coatings. Characteristics of the electrolytics processes. Immersion coatings . Organic coatings. Paints. Properties, formulation and quality control

Full-or-part-time: 6h 30m
Theory classes: 2h 30m
Practical classes: 2h
Self study : 2h

Chapter 7

Description:
Thermodynamic considerations. Initial states of oxidation. Oxidation kinetic. Electric conductivity of oxides. Oxides types. Alloys oxidation.

Full-or-part-time: 12h
Theory classes: 4h
Practical classes: 4h
Self study : 4h

Chapter 8

Description:
Polymer degradation. Types of degradation: thermoxidative, biological, thermal, photodegradation, mechanical, chemical

Full-or-part-time: 5h 30m
Theory classes: 2h
Practical classes: 2h
Self study : 1h 30m

Chapter 9

Description:
Degradation of ceramics. Corrosion of crystalline ceramics. Kinetic and thermodynamic aspects. Corrosion at high temperature and in aqueous solutions. Glass degradation.

Full-or-part-time: 17h
Theory classes: 6h
Practical classes: 5h
Self study : 6h

Tema 10

Description:
Friction and wear. Nature and texture of surfaces. Contact surface. Measurement and origin of friction. Friction theories.

Friction between materials. Types of wear. Mechanical wear processes. Corrosive wear. Wear maps. Lubrication.

Full-or-part-time: 18h
Theory classes: 6h
Practical classes: 6h
Laboratory classes: 6h

ACTIVITIES

CONTINUOUS EVALUATION 1

Description:
Exercises resolution of unit 1

Specific objectives:
Evaluation of the exercises sesion profit

Material:
Work exercises of unit 1

Delivery:
At the end of the sesion

Full-or-part-time: 2h
Theory classes: 2h

CONTINUOUS EVALUATION 2

Description:
Exercises resolution of unit 2

Specific objectives:
Evaluation of the exercises sesion profit

Material:
Work exercises of unit 2

Delivery:
At the end of the sesion

Full-or-part-time: 2h
Theory classes: 2h

CONTINUOUS EVALUATION 3

Description:
Exercises resolution of unit 3

Specific objectives:
Evaluation of the exercises sesion profit

Material:
Work exercises of unit 3

Delivery:
At the end of the sesion

Full-or-part-time: 2h
Theory classes: 2h

CONTINUOUS EVALUATION 4

Description:
Exercises resolution of unit 4

Specific objectives:
Evaluation of the exercises sesion profit

Material:
Work exercises of unit 4

Delivery:
At the end of the sesion

Full-or-part-time: 2h
Theory classes: 2h

CONTINUOUS EVALUATION 5

Description:
Exercises resolution of unit 5

Specific objectives:
Evaluation of the exercises sesion profit

Material:
Work exercises of unit 5

Delivery:
At the end of the sesion

Full-or-part-time: 2h
Theory classes: 2h

CONTINUOUS EVALUATION 6

Description:
Exercises resolution of unit 6

Specific objectives:
Evaluation of the exercises sesion profit

Material:
Work exercises of unit 6

Delivery:
At the end of the sesion

Full-or-part-time: 2h
Theory classes: 2h

CONTINUOUS EVALUATION 7

Description:
Presentation of real cases

Specific objectives:
Evaluation of the unit 7 profit

Delivery:
Programmed by the professor

Full-or-part-time: 2h
Theory classes: 2h

CONTINUOUS EVALUATION 8

Description:
Presentation of real cases

Specific objectives:
Evaluation of the unit 8 profit

Delivery:
Programmed by the professor

Full-or-part-time: 2h
Theory classes: 2h

CONTINUOUS EVALUATION 9

Description:
Presentation od real cases

Specific objectives:
Evaluation of the unit 9 profit

Delivery:
Programmed by the professor

Full-or-part-time: 2h
Theory classes: 2h

CONTINUOUS EVALUATION 10

Description:
Laboratory sessions

Full-or-part-time: 6h
Laboratory classes: 6h

GRADING SYSTEM

The final qualificacion of the contents will be:

NF1 = 1st PART [5% (2 laboratory sessions) + 10% (exercice sessions) + 35 % (partial exam-1st part)] +
2nd PART [22 % (practice sessions+seminars) + 6 % laboratory session + 22 % (partial exam-2nd part)]

Minimum qualification of each part must be higher than 3,0

If NF1 is lower than 5,0, the student has to go to re-evaluation exam:

NF2: Final exam (50% each part)

The students will be able to access the re-assessment test that meets the requirements set by the EEBE in its Assessment and Permanence Regulations (https://eebe.upc.edu/ca/estudis/normatives-academiques/documents/eebe-normativa-avaluacio-i-permanencia-18-19-aprovat-je-2018-06-13.pdf)

EXAMINATION RULES.

Complementary material will be avalaible for the student during the proves if it is especifically indicated by the professor.

BIBLIOGRAPHY

Basic:
- Bilurbina Alter, Lluís. Corrosión y protección [on line]. Barcelona: Edicions UPC, 2003 [Consultation: 27/04/2020]. Available on: http://hdl.handle.net/2099.3/36748. ISBN 8483017113.
- Uhlig, Herbert H. Corrosión y control de corrosión. Bilbao: Urmo, 1970. ISBN 8431401494.
- Revie, R. Winston ; Herbert H. Uhlig. Corrosion and corrosion control : an introduction to corrosion science and engineering. 4th ed. New York: Wiley-Interscience, 2008. ISBN 9780471732792.
- Hertzberg, Richard W. Deformation and fracture mechanics of engineering materials. 5th ed. New York: Wiley, 2013. ISBN 9780470527801.
- Rabinowicz, Ernest. Friction and wear of materials. 2nd. New York: John Wiley and Sons, 1995. ISBN 0471830844.
- Ludema, Kenneth C. Friction, wear, lubrication : a textbook in tribology. Boca Raton (Florida): CDC Press, cop. 1996. ISBN 9780849326851.
- Handbook of polymer degradation [on line]. 2nd ed. New York [etc.]: Marcel Dekker, cop. 2001 [Consultation: 27/04/2020]. Available on: https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=5378854. ISBN 9781482270181.

Complementary:
- Talbot, David. Corrosion science and technology. 3rd ed. Boca Raton: CRC Press, 2018. ISBN 9781498752411.
- Champion, F. A. Ensayos de corrosión. Bilbao: Urmo, 1976. ISBN 8431401486.