

Course guide

220070 - ME - Materials Engineering: Learning From Disasters

Last modified: 11/04/2025

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 702 - CEM - Department of Materials Science and Engineering.

Degree: BACHELOR'S DEGREE IN AEROSPACE TECHNOLOGY ENGINEERING (Syllabus 2010). (Optional subject).
BACHELOR'S DEGREE IN AEROSPACE VEHICLE ENGINEERING (Syllabus 2010). (Optional subject).
BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Optional subject).

Academic year: 2025 **ECTS Credits:** 3.0 **Languages:** English

LECTURER

Coordinating lecturer: VICENTE MARQUES CIFRE

Others:

REQUIREMENTS

It is necessary to have attended previous subjects related to science and technology of materials (to have basic concepts of fracture, fatigue, creep, corrosion, welding, non destructive test).

TEACHING METHODOLOGY

The course is divided into parts:

Theory classes

Practical classes

Self-study for doing exercises and activities.

In the theory classes, teachers will introduce the theoretical basis of the concepts, methods and results and illustrate them with examples appropriate to facilitate their understanding.

In the practical classes (in the classroom), teachers guide students in applying theoretical concepts to solve problems, always using critical reasoning. We propose that students solve exercises in and outside the classroom, to promote contact and use the basic tools needed to solve problems.

Students, independently, need to work on the materials provided by teachers and the outcomes of the sessions of exercises/problems, in order to fix and assimilate the concepts.

The teachers provide the syllabus and monitoring of activities (by ATENEA).

LEARNING OBJECTIVES OF THE SUBJECT

Failure study cases, often disaster, allow a good knowledge better than expected in relation to materials engineering. Usually, a good knowledge of Materials Science and Engineering provides information enough to avoid disaster. Thus, a good selection of materials and a careful choice of the environmental and service conditions can provide safety throughout the cycle life of a component or structure.

In this course, principles of corrosion or fracture mechanics are the basis for further study of historical failure cases. In addition, a review of the principal families of materials is promoted from:

- * Materials Selection Criteria
- * Interpretation of mechanical properties
- * Effect of environmental conditions on components and structures
- * Effect of industrial processing (heat treatment, bonding techniques, thermomechanical processes ...)

STUDY LOAD

Type	Hours	Percentage
Hours large group	30,0	40.00
Self study	45,0	60.00

Total learning time: 75 h

CONTENTS

Module 1: Fracture

Description:

1. Fracture principles, Fracture mechanisms in materials, Fracture characterization, Study cases

Full-or-part-time: 25h

Theory classes: 10h

Self study : 15h

Module 2: Corrosion

Description:

2. Corrosion principles, Corrosion mechanisms, Study cases

Full-or-part-time: 25h

Theory classes: 10h

Self study : 15h

Module 3: Other Failure Mechanisms

Description:

3. Other Failure mechanisms: Stress Cracking, Welding, Processing Defects, Crystallinity, Materials Selection? Study Cases

Full-or-part-time: 25h

Theory classes: 10h

Self study : 15h

GRADING SYSTEM

Deliverable module 1: 20%

Deliverable module 2: 20%

Deliverable module 3: 20%

Teamwork: 40%

BIBLIOGRAPHY

Complementary:

- Tawancy, Hani M.; Ul-Hamid, Anwar; Abbas, Nureddin M. Practical engineering failure analysis [on line]. New York: Marcel Dekker, 2004 [Consultation: 14/07/2025]. Available on: <https://doi-org.recursos.biblioteca.upc.edu/10.1201/9780203026298>. ISBN 9780429216268.
- Jones, David R. H. Failure analysis case studies. Amsterdam [etc.]: Pergamon, cop. 2001. ISBN 0080439594.
- Powell, Gordon W.; Mahmoud, Salah E. ASM handbook. Vol. 11, Failure analysis and prevention. 9th ed. Metals Park, Ohio: American Society for Metals, 1986.
- Brooks, Charlie R.; Choudhury, A. Metallurgical failure analysis. New York [etc.]: McGraw-Hill, cop. 1993. ISBN 007008078X.
- Reddy, A. Venugopal. Investigation of aeronautical and engineering component failures. Boca Raton, FL: CRC Press, 2004. ISBN 0849323142.