Course guide
295711 - COME - Mechanical Behaviour

Last modified: 07/01/2025

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

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

Academic year: 2024 **ECTS Credits:** 6.0 **Languages:** Spanish

LECTURER

Coordinating lecturer: LUIS MIGUEL LLANES PITARCH

Others:

REQUIREMENTS

PROPIETATS MECÀNIQUES DELS MATERIALS - Precorequisit

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CEMT-21. Knowledge of and the ability to apply the fundamentals of elasticity and strength of materials to the behaviour of real solids.

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:
04 COE N2. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 2. Using strategies for preparing and giving oral presentations. Writing texts and documents whose content is coherent, well structured and free of spelling and grammatical errors.

TEACHING METHODOLOGY

Lectures on theoretical and problem-solving issues are given throughout the course. Evaluation is done on the basis of written exams and oral presentations of proposed activities.

LEARNING OBJECTIVES OF THE SUBJECT

The main objective of the course is that student understands the importance of structure - mechanical property correlation in the material selection process regarding structural applications, according to service conditions requirements. In doing so, basic concepts are given on fracture, fatigue, and enviromental effects. In all the cases special emphasis is done on critical design parameters and selection of specific materials for each service condition.

STUDY LOAD

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

Total learning time: 150 h

CONTENTS

1. Introduction

Description:
Introduction: mechanical integrity, durability and reliability issues in structural applications.

Full-or-part-time: 7h 30m
Theory classes: 1h 30m
Practical classes: 1h 30m
Self study : 4h 30m

3. Fracture of materials

Description:
Fracture of materials. Types of fracture. Fractography. Fracture mechanics. Stress intensity factor. Fracture toughness. Evaluation of fracture toughness. Microstructural effects.

Full-or-part-time: 40h
Theory classes: 6h
Practical classes: 6h
Laboratory classes: 4h
Self study : 24h

3. Fatigue of materials

Description:
Fatigue. Cyclic deformation and crack nucleation. Fatigue crack propagation. Design criteria against fatigue.

Full-or-part-time: 47h 30m
Theory classes: 7h 30m
Practical classes: 7h 30m
Laboratory classes: 4h
Self study : 28h 30m

4. Enviromental effects on the mechanical response of materials.

Description:
Environmental assisted cracking. Corrosión fatigue. Case studies.

Full-or-part-time: 20h
Theory classes: 3h
Practical classes: 3h
Laboratory classes: 2h
Self study : 12h

5. High temperature mechanical response of materials.

Description:
Creep. Relationship among temperature, stress and strain rate. Deformation mechanisms at high temperature. Superplasticity. Deformationmechanisms maps.

Full-or-part-time: 7h 30m
Theory classes: 1h 30m
Practical classes: 1h 30m
Self study : 4h 30m

6. Mechanical properties and fracture behavior of polymers and composites

Description:
Mechanisms of plastic deformation in polymers. Curves stress - strain and relation with polymer's structure. Viscoelasticity in polymers. Impact testing of polymers. Fracture mechanics applied to polymers. Mechanical properties of polymer-matrix composites.

Full-or-part-time: 27h 30m
Theory classes: 6h
Practical classes: 3h
Laboratory classes: 2h
Self study : 16h 30m

GRADING SYSTEM

50% Final Exam + 30% Short (midterm) Tests + 10% Lab Reports + 10% Guided Activities.
If mean qualification of short tests is above 5, final exam becomes optional.
In case the student fails the course, it is possible to do a re-assessment test, in a date fixed by the School.
To be able of being re-assessed, the student must have been failed and must have taken all the evaluation tests of the subject, and have obtained a weighted average grade, N, of the re-assessment part of the subject, such that N> 3.0.
The re-assessment grade will be calculated as follows
NF= 80% Re-assessment test + 10% Lab Reports + 10% Guided Activities.
Qualifications for Lab Reports and Guided Activities will be those obtained during the regular course.

BIBLIOGRAPHY

Basic:
- Courtney, Thomas H. Mechanical behaviour of materials. 2nd. Long Grove, Illinois: Waveland, 2000. ISBN 1577664256.
- Hertzberg, Richard W.; Vinci, Richard P.; Hertzberg, Jason L. Deformation and fracture mechanics of engineering materials. 5th ed. New York: John Wiley & Sons, cop. 2013. ISBN 9780470527801.
- Suresh, Subra. Fatigue of materials. 2nd ed. Cambridge: Press Syndicate of the University of Cambridge, 1998. ISBN 0521578477.
- Dieter, George Ellwood. Mechanical metallurgy. London: McGraw Hill Book Company, 1988. ISBN 0071004068.
- Ward, Ian Macmillan; Sweeney, J. An Introduction to the mechanical properties of solid polymers. 2nd ed. Chichester: John Wiley & Sons, 2004. ISBN 047149626X.

Complementary:
- Meyers, Marc André; Armstrong, Ronald W.; Kirchner, Helmut O. K. Mechanics and materials : fundamentals and linkages. New York: John Wiley & Sons, 1999. ISBN 0471243175.
- With, Gijsbertus de. Structure, deformation, and integrity of materials. Weinheim: Wiley-VCH, 2006. ISBN 3527314261.

RESOURCES

Other resources:
Supporting academic resources available at ATENEA