Course guide
295752 - 295EM022 - Structural Integrity and Failure Analysis

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

Degree:
ERASMUS MUNDUS MASTER'S DEGREE IN ADVANCED MATERIALS SCIENCE AND ENGINEERING (Syllabus 2014). (Optional subject).
MASTER'S DEGREE IN MATERIALS SCIENCE AND ADVANCED MATERIALS ENGINEERING (Syllabus 2019). (Compulsory subject).
ERASMUS MUNDUS MASTER'S DEGREE IN ADVANCED MATERIALS SCIENCE AND ENGINEERING (Syllabus 2021). (Optional subject).

Academic year: 2022  ECTS Credits: 6.0  Languages: Spanish, English

LECTURER

Coordinating lecturer: FERHUN CEM CANER BASKURT

Others: Segon quadrimestre:
FERHUN CEM CANER BASKURT - T11, T12, T13
LUIS MIGUEL LLANES PITARCH - T11, T12, T13
ANTONIO MANUEL MATEO GARCIA - T11, T12, T13
ORLANDO ONOFRE SANTANA PEREZ - T11, T12, T13

DEGREE COMPETENCES TO WHICH THE SUBJECT CONtributes

Specific:
CEMCEAM-04. (ENG) Realizar estudios de caracterización y evaluación de materiales según sus aplicaciones
CEMCEAM-05. (ENG) Interpretar y aplicar normativas y especificaciones relativas a los materiales y sus aplicaciones

Transversal:
05 TEQ. TEAMWORK. Being able to work as a team player, either as a member or as a leader. Contributing to projects pragmatically and responsibly, by reaching commitments in accordance to the resources that are available.
06 URI. EFFECTIVE USE OF INFORMATION RESOURCES. Managing the acquisition, structure, analysis and display of information from the own field of specialization. Taking a critical stance with regard to the results obtained.

TEACHING METHODOLOGY

Lectures on theoretical and problem-solving issues, together with experimental activities, 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 objective of this course is to combine theoretical and practical knowledge of fatigue and fracture in materials, components and structures, as well as methods for evaluating structural integrity. The course pays special relevance to the analysis of cracks and notches in structural design and estimation of service life. It will provide a thorough knowledge in the field of fracture mechanics, with special relevance to its implementation to analyze the mechanical functionality of a material under different service conditions. Another fundamental objective of this course is the description of the general procedures, techniques and precautions to follow in the investigation and analysis of material failures. The stages of the investigation of failure during service will be discussed and the characteristics of the most common causes of breakage will be described.
## STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guided activities</td>
<td>6,0</td>
<td>4.00</td>
</tr>
<tr>
<td>Self study</td>
<td>96,0</td>
<td>64.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>42,0</td>
<td>28.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>6,0</td>
<td>4.00</td>
</tr>
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**Total learning time:** 150 h

## CONTENTS

### Tema 1. Introduction

**Description:**
Structural integrity as a field of knowledge. Mechanical design approaches. Fundamentals of elasticity and plasticity. Elastic, elastoplastic, viscoelastic and viscoplastic behavior.

**Full-or-part-time:** 8h 20m
- Theory classes: 3h
- Self study: 5h 20m

### Tema 2. Fundamentals of fracture

**Description:**

**Full-or-part-time:** 25h
- Theory classes: 8h
- Laboratory classes: 1h
- Self study: 16h

### Tema 3. Cohesive fracture, distributed fracture and method of size effect

**Description:**

**Full-or-part-time:** 25h
- Theory classes: 7h
- Guided activities: 2h
- Self study: 16h
Tema 4. Fatigue and structural integrity

Description:

Full-or-part-time: 50h
Theory classes: 14h
Laboratory classes: 2h
Guided activities: 2h
Self study: 32h

Tema 5. Non-destructive tests

Description:
Magnetic particles. Penetrating liquids. Ultrasonics. X-rays. Induced currents. Other techniques

Full-or-part-time: 8h 20m
Theory classes: 2h
Laboratory classes: 1h
Self study: 5h 20m

Tema 6. Failure in structural components

Description:
Failure causes in metallic, polymeric and ceramic components.

Full-or-part-time: 33h 20m
Theory classes: 8h
Laboratory classes: 2h
Guided activities: 2h
Self study: 21h 20m

GRADING SYSTEM

40% Final Exam + 40% Short (midterm) Tests + 20% Guided Activities.
If mean qualification of short tests is above 5, final exam becomes optional. There is no make-up exam in this course.
BIBLIOGRAPHY

Basic: