Course guides
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: 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 2014). (Optional subject).

Academic year: 2020  ECTS Credits: 6.0  Languages: Spanish

LECTURER

Coordinating lecturer: Llanes Pitarch, Luis Miguel

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

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>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>
<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>
</tbody>
</table>

Total learning time: 150 h
## 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:
Chemical analysis.
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.

BIBLIOGRAPHY

Basic: