295710 - PME - Mechanical Properties of Materials

Coordinating unit: 295 - EEBE - Barcelona East School of Engineering
Teaching unit: 702 - CMEM - Department of Materials Science and Metallurgy
Academic year: 2019
Degree: BACHELOR'S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)
ECTS credits: 6
Teaching languages: Spanish

Teaching staff
Coordinator: Llanes Pitarch, Luis Miguel
Others: Santana Perez, Orlando Onofre
Maspoch Ruldua, Maria Lluïsa

Prior skills

Degree competences to which the subject contributes

Specific:
CE9. Knowledge of science, technology and materials' chemistry fundamentals. Understanding the relation between microstructure, synthesis or processing and materials' properties.
CEM1. Knowledge on several types of materials' structure, as well as analysis characterisation and techniques of materials.
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.

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.
07 AAT N3. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

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 mechanical response of materials, elastic deformation and plasticity, strengthening mechanisms, fracture, fatigue, and environmental effects. In all the cases special emphasis is done on critical design parameters and selection of specific materials for each service condition.
**Study load**

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group:</th>
<th>45h</th>
<th>30.00%</th>
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<tbody>
<tr>
<td></td>
<td>Hours medium group:</td>
<td>0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Hours small group:</td>
<td>15h</td>
<td>10.00%</td>
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<tr>
<td></td>
<td>Guided activities:</td>
<td>0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Self study:</td>
<td>90h</td>
<td>60.00%</td>
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</tbody>
</table>
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## Content

<table>
<thead>
<tr>
<th>Section</th>
<th>Learning Time</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Introduction</strong></td>
<td>8h</td>
<td><strong>Description:</strong> Mechanical integrity, durability and reliability issues in structural applications. Mechanical response of structural materials: basic concepts of elasticity and plasticity.</td>
</tr>
<tr>
<td><strong>2. Deformation of materials</strong></td>
<td>24h</td>
<td><strong>Description:</strong> Theory of dislocations. Plastic deformation of single-crystals and poly-crystals. Mechanisms of deformation. Strengthening mechanisms: solid solution, aging, cold work, microstructural refinement, reinforcement through second phases (particles, fibers)</td>
</tr>
<tr>
<td><strong>4. Fatigue of materials</strong></td>
<td>28h</td>
<td><strong>Description:</strong> Fatigue. Cyclic deformation and crack nucleation. Fatigue crack propagation. Design criteria against fatigue</td>
</tr>
</tbody>
</table>
5. Environmental effects on the mechanical response of materials

**Learning time:** 12h
- Theory classes: 2h
- Practical classes: 2h
- Guided activities: 2h
- Self study: 6h

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

6. Mechanical properties and fracture behavior of polymers and composites

**Learning time:** 20h
- Theory classes: 6h
- Practical classes: 2h
- Laboratory classes: 2h
- Self study: 10h

**Description:**

**Qualification 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 (July). 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)

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:


Complementary:


Others resources:

Material docente disponible en ATENEA