Course guide
330122 - EMA - Materials Engineering

Unit in charge: Manresa School of Engineering
Teaching unit: 750 - EMIT - Department of Mining, Industrial and ICT Engineering.

Degree: BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2022 ECTS Credits: 6.0 Languages: Catalan

LECTURER

Coordinating lecturer: Soler Conde, Marc Antoni

Others: Soler Conde, Marc Antoni

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Knowledge of the mechanical behavior in service of the materials.
2. Know the basic processes of forming different types of engineering materials.
3. Select the most suitable material for basically structural applications.

Transversal:
4. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 3. Communicating clearly and efficiently in oral and written presentations. Adapting to audiences and communication aims by using suitable strategies and means.
5. EFFECTIVE USE OF INFORMATION RESOURCES - Level 3. Planning and using the information necessary for an academic assignment (a final thesis, for example) based on a critical appraisal of the information resources used.
6. 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

LEARNING OBJECTIVES OF THE SUBJECT

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>30,0</td>
<td>20.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>30,0</td>
<td>20.00</td>
</tr>
<tr>
<td>Self study</td>
<td>90,0</td>
<td>60.00</td>
</tr>
</tbody>
</table>

Total learning time: 150 h
<table>
<thead>
<tr>
<th>Title</th>
<th>Content</th>
<th>Full-or-part-time</th>
<th>Theory classes</th>
<th>Self study</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Els materials d’enginyeria i les seves propietats</td>
<td>Materials properties in engineering.</td>
<td>2h</td>
<td>1h</td>
<td>1h</td>
</tr>
<tr>
<td>Stress -strain in materials</td>
<td>content english</td>
<td>4h</td>
<td>2h</td>
<td>2h</td>
</tr>
<tr>
<td>Title eng3. Tensile test and properties.</td>
<td>Fundamentals of Young’s modulus Practical cases of design based on young’s modulus Yield stress Dislocations and sliding</td>
<td>9h</td>
<td>3h</td>
<td>6h</td>
</tr>
<tr>
<td>4. Fracture</td>
<td>Brittle fracture Mechanisms of fracture fracture probability in brittle materials</td>
<td>6h</td>
<td>2h</td>
<td>4h</td>
</tr>
<tr>
<td>5. Fatigue</td>
<td>Fatigue failure. Design based on fatigue Examples</td>
<td>8h</td>
<td>3h</td>
<td>5h</td>
</tr>
</tbody>
</table>
### 6. Creep

**Description:**
Kinetic theory of diffusion.
Creep mechanisms and resistant materials to hot creep.
A turbine blade: a practical case of creep-limited design at high temperature.

**Full-or-part-time:** 6h
- Theory classes: 2h
- Self study: 4h

### 7. Metallic materials

**Description:**
Ferrous alloys
- Steels
- Cast irons
Non ferrous alloys

**Full-or-part-time:** 8h
- Theory classes: 4h
- Self study: 4h

### 8. Non metallic materials

**Description:**
- Polymers
- Ceramics
- Composites

**Full-or-part-time:** 4h
- Theory classes: 2h
- Self study: 2h

### 9. Cold forming

**Description:**
- Rolling
- Deep drawing
- Streching

**Full-or-part-time:** 10h
- Theory classes: 4h
- Self study: 6h
10. Hot forming

Description:
Forging
Stamping
Rolling
Extrusion

Full-or-part-time: 10h
Theory classes: 4h
Self study: 6h

11. Materials selection

Description:
Material selection criteria
Objective function
Property maps

Full-or-part-time: 4h
Theory classes: 4h

ACTIVITIES

A.1. FEM exercises

Full-or-part-time: 30h
Theory classes: 16h
Laboratory classes: 14h

A.2. Quality systems and laboratory test

Full-or-part-time: 12h
Laboratory classes: 4h
Self study: 8h

A.3 Materials Selection

Description:
Problem resolution on materials selection.

Full-or-part-time: 7h
Laboratory classes: 4h
Self study: 3h
A.4. Test. FEM

Description:
Finite element modeling test

**Full-or-part-time:** 6h  
Self study: 6h

A.5. Progres test 1

**Full-or-part-time:** 2h  
Theory classes: 2h

Test

**Full-or-part-time:** 2h  
Theory classes: 2h

A.7. Presentation

Description:
Cours activity presentation

**Full-or-part-time:** 4h  
Laboratory classes: 4h

**GRADING SYSTEM**

\[ N = A_4 \times 0.3 + A_5 \times 0.25 + A_1 \times 0.25 + A_4 \times 0.10 + A_2 \times 0.05 + A_7 \times 0.05 \]

**BIBLIOGRAPHY**

**Basic:**

**Complementary:**
- Kobayashi, Shiro; Oh, Soo-Ik; Altan, Taylan. Metal forming and the finite-element method. New York: Oxford University Press,


**RESOURCES**

**Other resources:**
- Commercial calculation program using the ABAQUS finite element method.
- Laboratory equipment.