310002 - Mechanics

Degree competences to which the subject contributes

Specific:
1. FB-2 Applied knowledge of the general mechanics principles, the statics of structural systems, the mass geometry, the principles and methods of analysis of the elasticity of solids.

Transversal:
2. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

Teaching methodology

The learning hours of the subject alternate theoretical classes with practical classes where different exercises and problems are solved. In the theoretical classes, the faculty does a brief exposure to introduce the general learning objectives related with the basic concepts of the subject. Subsequently the faculty tries to motivate and involve the students through practical exercises. These practical classes facilitate individual aspects (concepts understanding, understanding of the wordings, specific applications, calculus methods, confidence) and collective aspects (teamwork, oral and written comprehension, variety in problem solving, question proposal). The faculty also propose exercises which can be solved at home and later explained at class.

Learning objectives of the subject

At the end of the course, students should be able to:

- Use vector methods in calculations of forces and calculations of moments in systems of forces.
- Determine, in static equilibrium conditions, reactions and internal forces in rigid solid systems and statically determinate structures.
- Define the characteristic concepts about geometry of masses (gravity centre, moment of inertia, product of inertia) and calculate and use them properly.
- Appropriately interpret the tables of moments of inertia.
- Determine the inertia tensors and the main axis of inertia.
- Explain the pressure concept, the behaviour of forces in a liquid in static equilibrium and the meaning of the pressure
centre. Relate this concept with systems of forces.

- Define the elastic magnitudes and interpret the meaning of the elastic modules. Use analytic methods in order to determine elastic variables.

<table>
<thead>
<tr>
<th>Study load</th>
<th>Hours large group:</th>
<th>Hours medium group:</th>
<th>Hours small group:</th>
<th>Guided activities:</th>
<th>Self study:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total learning time:</strong> 225h</td>
<td>67h 30m</td>
<td>22h 30m</td>
<td>0h</td>
<td>0h</td>
<td>135h</td>
</tr>
<tr>
<td></td>
<td>30.00%</td>
<td>10.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>60.00%</td>
</tr>
</tbody>
</table>
# 310002 - Mechanics

## Content

### C1 Systems of forces

**Learning time:** 42h  
- Theory classes: 14h  
- Practical classes: 2h  
- Guided activities: 0h  
- Self study: 26h

**Description:**
Content of the lesson:

**Related activities:**
PE1 Written problem that belongs to the continuous assessment. It includes contents 1 and 2. Carried out after completing the content 2.  
ExFin and R The final exam and reappraisal include all the contents.

### C2 Analytic statics and structures

**Learning time:** 68h  
- Theory classes: 25h  
- Practical classes: 4h  
- Guided activities: 0h  
- Self study: 39h

**Description:**
Content of the lesson:
Part 1  
Part 2  

**Related activities:**
PE1 Exercises individual test that belong to the continuous assessment. It includes the contents 1 and 2. To do after content 2.  
ExFin and R The final exam and reappraisal include all the contents.  
CT7.1 Independent learning level 1.
### C3 Center of mass and moment of inertia

**Learning time:** 40h  
Theory classes: 13h 45m  
Practical classes: 1h 45m  
Guided activities: 0h  
Self study: 24h 30m

**Description:**  
Content:  
Center of mass: concept and properties.  
Center of volume mass, plain figures and material lines.  
Center of mass of homogeneous and uniform figures.  
First static momento. Pappus-Guldin theorem.  

**Related activities:**  
P2 Exercises individual test that belong to the continuous assessment. It includes the contents 3 and 4. To do after content 4.  
ExFin and R The final exam and reappraisal include all the contents.

### C4 Static fluids and superficial phenomena

**Learning time:** 27h  
Theory classes: 8h 45m  
Practical classes: 1h 15m  
Guided activities: 0h  
Self study: 17h

**Description:**  
Content:  

**Related activities:**  
PE2 Exercises individual test that belong to the continuous assessment. It includes the contents 3 and 4. To do after content 4.  
ExFin and R The final exam and reappraisal include all the contents.
## C5 Elasticity

**Learning time:** 48h  
Theory classes: 17h 15m  
Practical classes: 2h 15m  
Guided activities: 0h  
Self study: 28h 30m  

### Description:

Content:  

### Related activities:

ExFin and R. The final exam and reappraisal include all the contents.
### Planning of activities

| PE1  PRACTICAL TEST 1 | Hours: 6h  
Practical classes: 2h  
Self study: 4h |
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Continuous assessment individual written test. Exercises of contents 1 and 2. Done after the end of content 2. 30% of the weighted average mark. (See qualification system).</td>
</tr>
<tr>
<td><strong>Support materials:</strong></td>
<td>Wording, blank paper, calculator, drawing and writing material.</td>
</tr>
<tr>
<td><strong>Descriptions of the assignments due and their relation to the assessment:</strong></td>
<td>The test is given on paper.</td>
</tr>
<tr>
<td><strong>Specific objectives:</strong></td>
<td>Show the learning of contents 1 and 2.</td>
</tr>
</tbody>
</table>

| PE2  PRACTICAL TEST 2 | Hours: 6h  
Practical classes: 2h  
Self study: 4h |
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Continuous assessment individual written test. Exercises of contents 3 and 4. Done after the end of content 4. 20% of the weighted average mark. (See qualification system).</td>
</tr>
<tr>
<td><strong>Support materials:</strong></td>
<td>Wording, blank paper, calculator, drawing and writing material.</td>
</tr>
<tr>
<td><strong>Descriptions of the assignments due and their relation to the assessment:</strong></td>
<td>The test is given on paper.</td>
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<tr>
<td><strong>Specific objectives:</strong></td>
<td>Show the learning of contents 3 and 4.</td>
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| EXFIN  FINAL EXAM | Hours: 11h  
Practical classes: 2h  
Self study: 9h |
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Continuous assessment individual written test. Exercises of all the contents. 50% of the weighted average mark. (See qualification system).</td>
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<td><strong>Support materials:</strong></td>
<td>Wording, blank paper, calculator, drawing and writing material.</td>
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<td>Students must be able to answer all the theoretical and practical questions, and to solve the exercises of the entire course.</td>
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### REAPPRAISAL

<table>
<thead>
<tr>
<th>Description:</th>
<th>Hours: 6h</th>
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<tbody>
<tr>
<td>Individual written test. Exercises of all the contents.</td>
<td>Self study: 4h</td>
</tr>
<tr>
<td>See qualification system for details.</td>
<td>Practical classes: 2h</td>
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<th>Specific objectives:</th>
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<td>Students must be able to answer all the theoretical and practical questions, and to solve the exercises of the entire course.</td>
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### CT7.1 LEVEL 1 SELF-LEARNING

<table>
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<tr>
<th>Description:</th>
<th>Hours: 8h</th>
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<tbody>
<tr>
<td>The self-learning is about the equilibrium of the parts of a whole in equilibrium. When the concepts and the static methods have already been acquired, theoretical and practical contents are given with bibliographical references and examples that let to understand and go through the contents in a gradual way. Questions can be asked to the teachers.</td>
<td>Self study: 8h</td>
</tr>
</tbody>
</table>

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<th>Support materials:</th>
<th></th>
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<tbody>
<tr>
<td>During the preparation: available Atenea Campus connection, books, calculator, blank paper, drawing and writing material.</td>
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<th>Descriptions of the assignments due and their relation to the assessment:</th>
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<td>See qualification system.</td>
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<th>Specific objectives:</th>
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<tbody>
<tr>
<td>Achieve the competence of level 1 self-learning.</td>
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**Qualification system**

There will be two practices (PE1 and PE2) and a final exam (ExFin).

The first practice PE1 includes the contents 1 and 2. The weight of the practice is a 30% of the final grade. This exercise will be done at the partial exams term.

The second practice PE2 includes the contents 3 and 4. The weight of the practice is a 20% of the final grade. This exercise will be done during the 12-13 week.

The final exam ExFin includes all the contents. The weight of this exam is a 50% of the final grade.

According to Normativa Académica de Estudios de Grado y Máster de la UPC and EPSEB, the final evaluation of the subject will be done as it is described.

The final grade of the subject will be the larger between these two grades:

a) m: Arithmetic mean of the pertinent marks of PE1, PE2 and ExFin.

\[
m = 0.3p + 0.2s + 0.5f
\]

where

p = PE1 practice mark.

s = PE2 practice mark.

f = ExFin final exam mark.

b) f: Final exam mark.

**Reappraisal**

The student who has failed the subject with a numerical mark between 3.5 and 4.9 will have the opportunity to do an unique reappraisal exam, which will include all the contents of the subject and will be done in a settled term. If the student pass the exam, his final mark of the subject will be 5.0.

The student won't be able to do this reappraisal exam if:

i) The student has already passed the subject.

ii) The student's final mark is less than 3.5 (including NP).

**Regulations for carrying out activities**

If a student has failed the subject and has not done the final exam the final grade will be NP.
Bibliography

Basic:


Complementary:


Others resources:

Audiovisual Material

- DVD Humitats per capil·laritat
  Rodríguez Cantalapiedra, I.; Lacasta, A; Sarró, P.