310702 - 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.
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- 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.

**Study load**

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group:</th>
<th>30h</th>
<th>20.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group:</td>
<td>9h</td>
<td>6.00%</td>
</tr>
<tr>
<td></td>
<td>Hours small group:</td>
<td>21h</td>
<td>14.00%</td>
</tr>
<tr>
<td></td>
<td>Guided activities:</td>
<td>0h</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>Self study:</td>
<td>90h</td>
<td>60.00%</td>
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## Content

<table>
<thead>
<tr>
<th>C1 Systems of forces</th>
<th>Learning time: 30h 10m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>Newton's Laws</td>
</tr>
<tr>
<td></td>
<td>Theory classes: 3h</td>
</tr>
<tr>
<td></td>
<td>Practical classes: 7h</td>
</tr>
<tr>
<td></td>
<td>Self study: 20h 10m</td>
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<table>
<thead>
<tr>
<th>C2 Analytic statics and structures</th>
<th>Learning time: 46h 50m</th>
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<tbody>
<tr>
<td>Description:</td>
<td>Statics.</td>
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<tr>
<td>Theory classes:</td>
<td>3h</td>
</tr>
<tr>
<td>Practical classes:</td>
<td>15h</td>
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<tr>
<td>Self study:</td>
<td>28h 50m</td>
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</table>

<table>
<thead>
<tr>
<th>C3 Center of mass and moment of inertia</th>
<th>Learning time: 37h 10m</th>
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<tbody>
<tr>
<td>Description:</td>
<td>mass center</td>
</tr>
<tr>
<td>Theory classes:</td>
<td>6h</td>
</tr>
<tr>
<td>Practical classes:</td>
<td>12h</td>
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<tr>
<td>Self study:</td>
<td>19h 10m</td>
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<table>
<thead>
<tr>
<th>C5 Elasticity</th>
<th>Learning time: 35h 50m</th>
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<tbody>
<tr>
<td>Description:</td>
<td></td>
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<tr>
<td>Theory classes:</td>
<td>6h</td>
</tr>
<tr>
<td>Practical classes:</td>
<td>8h</td>
</tr>
<tr>
<td>Self study:</td>
<td>21h 50m</td>
</tr>
</tbody>
</table>
## Planning of activities

### PE1  PRACTICAL TEST 1

**Description:**
Continuous assessment individual written test. Exercises of contents of the first half part of the subject. 25% of the weighted average mark. (See qualification system).

**Support materials:**
Wording, blank paper, calculator, drawing and writing material.

**Descriptions of the assignments due and their relation to the assessment:**
The test is given on paper.

**Specific objectives:**
Show the learning of contents of first half part of the subject.

<table>
<thead>
<tr>
<th>Hours</th>
<th>Practical classes: 2h</th>
<th>Self study: 4h</th>
</tr>
</thead>
<tbody>
<tr>
<td>6h</td>
<td></td>
<td></td>
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</tbody>
</table>

### PE2  PRACTICAL TEST 2

**Description:**
Continuous assessment individual written test. Exercises of contents of second half part of the subject. Done at the end of the period. 25% of the weighted average mark. (See qualification system).

**Support materials:**
Wording, blank paper, calculator, drawing and writing material.

**Descriptions of the assignments due and their relation to the assessment:**
The test is given on paper.

**Specific objectives:**
Show the learning of contents of the second half part of the subject

<table>
<thead>
<tr>
<th>Hours</th>
<th>Practical classes: 2h</th>
<th>Self study: 4h</th>
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</thead>
<tbody>
<tr>
<td>6h</td>
<td></td>
<td></td>
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</table>

### EXFIN  FINAL EXAM

**Description:**
Continuous assessment individual written test. Exercises of all the contents. 50% of the weighted average mark. (See qualification system).

**Support materials:**
Wording, blank paper, calculator, drawing and writing material.

**Descriptions of the assignments due and their relation to the assessment:**
The test is given on paper.

**Specific objectives:**
Students must be able to answer all the theoretical and practical questions, and to solve the exercises of the entire course.

<table>
<thead>
<tr>
<th>Hours</th>
<th>Practical classes: 2h</th>
<th>Self study: 9h</th>
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<tbody>
<tr>
<td>11h</td>
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</tbody>
</table>

Practical classes: 2h
Self study: 9h

Hours: 6h
### REAPPRAISAL

**Description:**
Individual written test. Exercises of all the contents. See qualification system for details.

**Support materials:**
Wording, blank paper, calculator, drawing and writing material.

**Descriptions of the assignments due and their relation to the assessment:**
The test is given on paper.

**Specific objectives:**
Students must be able to answer all the theoretical and practical questions, and to solve the exercises of the entire course.

<table>
<thead>
<tr>
<th><strong>CT7.1 LEVEL 1 SELF-LEARNING</strong></th>
<th><strong>Hours:</strong> 8h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Self study: 8h</td>
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</tbody>
</table>

**Description:**
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.

**Support materials:**
During the preparation: available Atenea Campus connection, books, calculator, blank paper, drawing and writing material.

**Descriptions of the assignments due and their relation to the assessment:**
See qualification system.

**Specific objectives:**
Achieve the competence of level 1 self-learning.
Qualification system

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

The first practice PE1 includes the first half part of the matter. The weight of the practice is a 25% of the final grade. This exercise will be done at the partial exams term.
The second practice PE2 includes the second half part of the matter. The weight of the practice is a 25% of the final grade. This exercise will be done at the end of the period.
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.

\[
m = 0.25p + 0.25s + 0.5f
\]

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.
- Mobiles are not allowed during the exam.
- The entry to the exam will be denied once started.
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Bibliography

Basic:


Complementary:


Others resources:

Audiovisual Material

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