Degree competences to which the subject contributes

Specific:
1. Understanding and dominion of basic concepts on mechanics, thermodynamics, fields and waves and electromagnetism laws and their application to solve engineering problems.

Teaching methodology

Halfway through the course, and therefore within the learning process, the student will perform one evaluation tests. These tests will have a relative difficulty depending on the period in which they take place and will be used to evaluate and guide each student with respect to the success in acquiring the required competencies and capacities.

Towards the end of the academic period practical laboratory sessions will take place. Each laboratory session must be conveniently prepared by the student considering those concepts acquired during the course. Finally, evaluation tests, of those competencies and capacities acquired during the course, will take place at the end of the learning period. These tests have a relative significance as it is detailed in the "Qualification system" section.

Learning objectives of the subject

Acquiring the capacity to correctly interpret and apply fundamental laws of mechanics.
- Identifying a common methodology in the description of different mechanical phenomena, no matter if it is a single particle's movement, a solid object or a wave movement.
- Efficient use of graphic language to solve and interpret problems.
- Acquiring ability to execute measures and later treating the obtained data.
- Solving problems on simple mechanical applications.
- Having the capacity to identify each magnitude that appears in different formulas.
- Having the capacity to express magnitudes in the International System units.
240013 - Basic Mechanics

- Having the capacity to choose a problem's fastest and simpler resolution option.
- Having the capacity to correctly use vector notation when necessary.

### Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group: 52h</th>
<th>34.67%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group: 0h</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>Hours small group: 8h</td>
<td>5.33%</td>
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<tr>
<td></td>
<td>Guided activities: 0h</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>Self study: 90h</td>
<td>60.00%</td>
</tr>
</tbody>
</table>
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## Content

<table>
<thead>
<tr>
<th>Topic 1: Physic and mathematic fundaments of mechanics</th>
<th>Learning time: 21h 30m</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 2h 24m</td>
</tr>
<tr>
<td></td>
<td>Practical classes: 0h 48m</td>
</tr>
<tr>
<td></td>
<td>Laboratory classes: 2h</td>
</tr>
<tr>
<td></td>
<td>Self study : 16h 18m</td>
</tr>
</tbody>
</table>

**Description:**
1) Space, time and reference systems.
2) Coordinate systems. Cartesian Euclidian coordinates. Distance.
4) Symmetry principle.
5) Experimental data measure and treatment.
7) Kinematics of the point: position, trajectory, speed and acceleration.

<table>
<thead>
<tr>
<th>Topic 2: Mechanics of a single particle</th>
<th>Learning time: 21h 42m</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 4h 30m</td>
</tr>
<tr>
<td></td>
<td>Practical classes: 1h 36m</td>
</tr>
<tr>
<td></td>
<td>Self study : 15h 36m</td>
</tr>
</tbody>
</table>

**Description:**
2) Force and momentum.
3) Force momentum and angular momentum.
4) Work, kinetic energy and potential energy.
5) Examples: F=0, F=ct, F=-kx, central forces, gyroscopic forces, friction forces.
### Topic 3: Mechanics of N particles

**Learning time:** 33h 54m  
- Theory classes: 6h 48m  
- Practical classes: 9h 36m  
- Self study: 17h 30m

**Description:**  
1) Third Newton's law: forces between particles.  
2) Centre de masses.  
3) Momentum.  
4) Angular momentum.  
5) Work, kinetic energy and potential energy.  
6) Crashes.  
7) Gravitational and electromagnetic interaction.  
8) Links and reactions. Possible displacements and virtual displacements. Ideal reactions.  
9) Dynamics general equation or d'Alembert's principle.  

### Topic 4: Rigid solid statics

**Learning time:** 24h 18m  
- Theory classes: 4h 24m  
- Practical classes: 8h 12m  
- Self study: 11h 42m

**Description:**  
1) Solid's statics.  
2) Weight and gravity centre.  
3) Forces on solids due to gravitating solids. Archimedes' principle.  
4) Supports and reaction forces. Free solid diagram.  
5) Solid systems' statics.  
6) Virtual work principle.  
7) Balance and stability.

### Topic 5: Rigid solid dynamics in the plane

**Learning time:** 23h 12m  
- Theory classes: 3h 12m  
- Practical classes: 5h  
- Laboratory classes: 2h  
- Self study: 13h

**Description:**  
1) Solid's kinematics.  
2) Translation equation.  
3) Rotation equation. Angular momentum. Inertia momentum.  
4) Rotation and translation kinetic energy.
Topic 6: Small oscillations

Description:
1) Small oscillations around the balance position.
2) Simple harmonic movement.
3) Damped harmonic movement.
4) Forced harmonic movement.

Planning of activities

LABORATORY PRACTICES

Description:
Towards the end of the academic period, students will take 3 laboratory sessions. Generally practices are prepared outside the laboratory, and they take place integrally in the session (2 hours), including calculations and report (from a pattern).

Session 1: A common practice related to Topic 1
(1) Data treatment. Hooke's law.

With enough time students are given a data treatment problem which must be solved by consulting the corresponding theory. This problem's solution will serve as a guideline to execute the practice in which the measures are real.

Session 2: One of the three following related with topics 3, 4 and 5
(2) Dynamics experiences I. Translation.
(3) Dynamics experiences II. Rotation. Reversible pendulum.
(4) Dynamics experiences III. Translation and rotation. Maxwell's wheel.

Session 3: One of the three following related with topics 6 and 7
(5) Forced oscillations.
(6) Waves I: Stationary waves in a single cord.
(7) Waves II: speed of sound in the air.
Qualification system

NTOT = 0,6 NEF + 0,2 NMQ + 0,2 NLAB

NTOT: Subject’s final mark.
NEF: Final exam mark.
NMQ: Midterm’s mark.
NLAB: Average mark of the laboratory reports.

Regulations for carrying out activities

Half-term test will consist primarily of test questions that could be supplemented with an exercise reasoned.

Final exam will consist of 2 parts. The first one will be a multiple choice test with closed questions (no justification needed). In the second part, each student will have to solve a series of exercises reasoning each answer. In every test/exam, students will be allowed to use an official formulary given by the professor at the beginning of the course. They will also be allowed to use a non-programable calculator.

Bibliography

Complementary:


Others resources:

Hyperlink

Curso Interactivo de Física en Internet. Ángel Franco García
http://www.sc.ehu.es/sbweb/fisica

OpenStax
https://openstax.org/details/books/university-physics-volume-1