220016 - M - Mechanics

Degree competences to which the subject contributes

Specific:

2. GrETA/GrEVA - Applied knowledge of materials science and technology; mechanics and thermodynamics; fluid mechanics; aerodynamics and flight mechanics; navigation systems and air traffic; aerospace technology; structural theory; economy and production; projects; environmental impact.

Transversal:

1. 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.

Teaching methodology

The educational methodology is divided into four parts:

- Presencial sessions of contents exhibition
- Presencial sessions of practical work
- Autonomous work of study and realization of exercises and activities

In the content exhibition sessions the teaching staff will introduce the theory bases of the subject, methods, concepts and results with examples of engineer character to facilitate their understanding.

The teaching staff will guide students in the application of the theory concepts for solve problems related with industrial engineering in the sessions of practical work in the classroom. It will purpose exercises which students have to solve in the classroom with partners and the teacher, or out of the classroom, in order to learn the utilization of tools for solving problems.

The autonomous work will consist on problems and conceptual questions which are proposed in the bibliography. They will develop everything what has been seen in the presencial sessions of content exhibition and practical work.

Learning objectives of the subject

The subject introduces to student in applied knowledge of the mechanics and in the concepts and principles which determine the behaviour of the structures with dynamic solicitations on duty.
## Study load

<table>
<thead>
<tr>
<th></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> 112h 30m</td>
<td>31h</td>
<td>14h</td>
<td>0h</td>
<td>0h</td>
<td>67h 30m</td>
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<td></td>
<td>27.56%</td>
<td>12.44%</td>
<td>0.00%</td>
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</tbody>
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## Content

### -1.1 Particle kinematics

**Description:**
- Reference and base
- Intrinsic components
- Composition of movements

**Related activities:**
1, 2, 3

**Specific objectives:**
Recovery of concepts seen in previous subjects.

<table>
<thead>
<tr>
<th>Learning time: 7h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 2h</td>
</tr>
<tr>
<td>Practical classes: 1h</td>
</tr>
<tr>
<td>Self study: 4h</td>
</tr>
</tbody>
</table>

### -1.2 Rigid Solid Movements

**Description:**
- Degrees of freedom
- Movements of the solid: rotation and translation
- Properties of the movement
- Instantaneous axis of rotation

**Related activities:**
1, 2, 3

**Specific objectives:**
Understand the motion of solids in space and apply the concepts and expressions typical of this topic to solving problems of motion of solids and systems of solids in space.

<table>
<thead>
<tr>
<th>Learning time: 18h 30m</th>
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<tbody>
<tr>
<td>Theory classes: 4h</td>
</tr>
<tr>
<td>Practical classes: 2h</td>
</tr>
<tr>
<td>Self study: 12h 30m</td>
</tr>
</tbody>
</table>
### -1.3 Solids in contact

**Learning time:** 20h  
Theory classes: 6h  
Practical classes: 2h  
Self study: 12h

**Description:**  
Contact point  
Relative motion  
Succession rate  
Speed and acceleration of the point of contact

**Related activities:**  
1, 2, 3

**Specific objectives:**  
Understand the movement of solids in contact. Apply the expressions and concepts related to the motion of two solids in contact to solve problems.

### -1.4 Flat kinematics

**Learning time:** 16h  
Theory classes: 4h  
Practical classes: 2h  
Self study: 10h

**Description:**  
Simplification of the kinematics of space to plane motion.

**Related activities:**  
Simplification of the kinematics of space to plane motion.

**Specific objectives:**  
Solving problems of plane kinematics.

### -1.5 Particle dynamics

**Learning time:** 5h  
Theory classes: 2h  
Practical classes: 1h  
Self study: 2h

**Description:**  
Newton Laws  
Inertial and non-inertial references  
Moment of a force

**Specific objectives:**  
Recover concepts seen in other previous subjects in the area of Physics.
-1.6 Theorems of dynamics

**Description:**
The Quantity of Motion Theorem
Kinetic Moment Theorem
Kinetic Energy Theorem

**Specific objectives:**
Determine the relationship between the applied forces and the kinematic magnitudes. Learn to work with a particle system.

**Learning time:** 7h
Theory classes: 2h
Practical classes: 1h
Self study: 4h

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-1.7 Inertia

**Description:**
Definition and properties of moments of inertia
Product of inertia
Inertia matrix
Steiner's theorem
Directions and main moments of inertia
Symmetry considerations

**Specific objectives:**
Learn to calculate the inertia matrix of a solid

**Learning time:** 5h
Theory classes: 2h
Practical classes: 1h
Self study: 2h

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-1.8 Dynamics of the solid

**Description:**
The Quantity of theorem of motion
Kinetic Moment Theorem
Kinetic Energy Theorem
Conditions of connection

**Specific objectives:**
Determination of the equations of motion of a solid or system of solids

**Learning time:** 18h
Theory classes: 5h
Practical classes: 2h
Guided activities: 0h
Self study: 11h
-1.9 Flat dynamics

**Description:**
Simplification of the equations of space motion in the plane case

**Related activities:**
Simplification of the kinematics of space to plane motion

**Specific objectives:**
Resolution of the dynamics of flat mechanisms

**Learning time:** 16h
- Theory classes: 4h
- Practical classes: 2h
- Self study: 10h
## Planning of activities

### SESSIONS IN LARGE GROUPS

| Description: | Preparation before and after the sessions and attendance at the sessions |
| Support materials: | Notes on the Athena platform, General bibliography of the subject |
| **Descriptions of the assignments due and their relation to the assessment:** | Resolution of exercises in class or autonomously that will be part of the 20% of the mark of ordinary activities |
| **Specific objectives:** | Establish the theoretical principles of the subject, Transfer theoretical principles to solving practical engineering cases, Approach engineering problems systematically, Formulate hypotheses based on theoretical expressions |

### MEDIUM GROUP SESSIONS

| Description: | Individual or group resolution of problems of the subject |
| Support materials: | General bibliography of the subject |
| **Descriptions of the assignments due and their relation to the assessment:** | Resolution of exercises in class that will be part of the 20% of the mark of ordinary activities |
| **Specific objectives:** | Solve problems related to the dynamics of solids systems |

### PARTIAL EXAMINATION

| Description: | Individual and written test of the contents of kinematics |
| Support materials: | Statement of the partial test |
| **Descriptions of the assignments due and their relation to the assessment:** | Resolution of the test, 30% of the final grade |
| **Specific objectives:** | The test must show that the student has acquired the necessary knowledge of kinematics of the rigid solid. |
**FINAL EXAM**

| Description: | Theory classes: 2h  
| Support materials: | Self study: 23h 20m |

**Support materials:**
- Statement of the final test

**Descriptions of the assignments due and their relation to the assessment:**
- Resolution of the test. 50% of the final grade

**Specific objectives:**
- The test must show that the student has acquired the necessary knowledge of the dynamics and kinematics of the rigid solid.

**Qualification system**

- Partial examination: 30%
- Final exam: 50%
- Ordinary activities of class (partial): 10%
- Ordinary activities of class (final): 10%

All those students who cannot attend the partial examination or who not pass it, will have the option to recover the note by taking the final exam of the subject. The passing of the final exam with a grade equal to or higher than 5 replaces the partial exam grade with a 5 point qualification.

**Regulations for carrying out activities**

The partial and final examination will be individual without material support (notes or books). The ordinary activities will develop in groups with other classmates and teacher but without material support.
Bibliography

Basic:


Complementary:


Others resources:

Notes of the subject

Audiovisual material

Apunts de Mecànica