Degree competences to which the subject contributes

Specific:
1. D1. Knowledge of fundamental principals of mechanics of solids rigids and its application of resolving problems concerning engineering (CINEMATICA, statics, dynamics)
2. D2. Ability to define conditions and functions of pneumatic and hydraulic systems applicable to machines and mechanic systems.
3. D3. Ability to draw up proposals of pneumatic and hydraulic system configurations.

Transversal:
4. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.

Learning objectives of the subject

At the end of the course the student should be able to:

- Analyze and relate solicitations, efforts and movements in mechanical systems.
- Knowledge of hydraulic and pneumatic components, and symbols of representation for the interpretation of hydraulic and pneumatic circuits.
- Size and select the different pneumatic and hydraulic components.
- Simulate the behavior of a pneumatic and hydraulic circuit using a simulation program.
- Decide what time is used for each task from a time guideline.
- Work with the sources of information that the teacher tells you and with which he or she expands.
### Study load

<table>
<thead>
<tr>
<th></th>
<th>Total learning time: 150h</th>
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</thead>
<tbody>
<tr>
<td>Hours large group:</td>
<td>42h</td>
</tr>
<tr>
<td>Hours medium group:</td>
<td>0h</td>
</tr>
<tr>
<td>Hours small group:</td>
<td>6h</td>
</tr>
<tr>
<td>Guided activities:</td>
<td>0h</td>
</tr>
<tr>
<td>Self study:</td>
<td>102h</td>
</tr>
</tbody>
</table>

- **Hours large group:** 42h (28.00%)
- **Hours medium group:** 0h (0.00%)
- **Hours small group:** 6h (4.00%)
- **Guided activities:** 0h (0.00%)
- **Self study:** 102h (68.00%)
### Content

<table>
<thead>
<tr>
<th>1- Structural analysis of mechanisms</th>
<th>Learning time: 10h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Theory classes: 3h</td>
</tr>
<tr>
<td>1.1 Basic definitions in machines theory</td>
<td>Laboratory classes: 2h</td>
</tr>
<tr>
<td>1.2 Members and kinematic links</td>
<td>Guided activities: 3h</td>
</tr>
<tr>
<td>1.3 Types of mechanisms</td>
<td>Self study: 2h</td>
</tr>
<tr>
<td>1.4 Kinematic scheme of a mechanism</td>
<td></td>
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<tr>
<td>1.5 Degrees of freedom of a mechanism</td>
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<tr>
<td><strong>Related activities:</strong></td>
<td></td>
</tr>
<tr>
<td>A1 = Learning evaluation</td>
<td></td>
</tr>
<tr>
<td>A2 = Laboratory practices</td>
<td></td>
</tr>
<tr>
<td>A3 = Reporting activities</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>2- Vector mecanics</th>
<th>Learning time: 4h</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Theory classes: 2h</td>
</tr>
<tr>
<td>2.1 Basic concepts and definitions</td>
<td>Guided activities: 2h</td>
</tr>
<tr>
<td>2.2 Vectorial operations and trigonometry</td>
<td></td>
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<tr>
<td>2.3 Moment of a force</td>
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<tr>
<td>2.4 Equivalent systems of forces</td>
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</tr>
<tr>
<td><strong>Related activities:</strong></td>
<td></td>
</tr>
<tr>
<td>A1 = Learning evaluation</td>
<td></td>
</tr>
<tr>
<td>A2 = Laboratory practices</td>
<td></td>
</tr>
<tr>
<td>A3 = Reporting activities</td>
<td></td>
</tr>
</tbody>
</table>
### 3 - Mass geometry

**Learning time:** 12h  
Theory classes: 4h  
Guided activities: 2h  
Self study: 6h

<table>
<thead>
<tr>
<th>Description:</th>
</tr>
</thead>
</table>
| 3.1 Center of gravity  
3.2 Inertial moment |  
| Related activities: |  
| A1 = Learning evaluation  
A2 = Laboratory practices  
A3 = Reporting activities |  

### 4 - Statics of rigid bodies

**Learning time:** 50h  
Theory classes: 16h  
Guided activities: 4h  
Self study: 30h

<table>
<thead>
<tr>
<th>Description:</th>
</tr>
</thead>
</table>
| 4.1 Introduction  
1st and 3rd Newton's law.  
Basic concepts: rigid body, force, mass and weight.  
Free body diagrams.  
Equations of equilibrium of a rigid body.  
Moment of a force about a point.  
Concept of Coulomb friction force.  
4.2 Problems of statics of rigid bodies.  
4.3 Virtual Power's Theorem |  
| Related activities: |  
| A1 = Learning evaluation  
A2 = Laboratory practices  
A3 = Reporting activities |  

**Specific objectives:**  
At the end of this unit the student should be able to:  

- Solve problems of statics of two-dimensional rigid bodies with coplanar force systems, either with the intervention of friction forces or not.
### 5 - Kinematics of rigid bodies

**Description:**
Position and velocity analysis in a planar mechanism.

**Related activities:**
- A1 = Learning evaluation
- A2 = Laboratory practices
- A3 = Reporting activities

**Specific objectives:**
After completing this unit the student should be able to:

- Determine in a rigid body the linear speed of a point and the angular velocity of the solid from sufficient kinematic data.
- Perform the analysis of position and velocities of a planar mechanism.

**Learning time:** 37h
- Theory classes: 12h
- Guided activities: 3h
- Self study: 22h

### 6 - Dynamics of rigid bodies

**Description:**
6.1 2nd law of Newton and D'Alembert method
  - Inertial force
  - Moment of inertia
  - Moment due to inertia

**Related activities:**
- A1 = Learning evaluation
- A2 = Laboratory practices
- A3 = Reporting activities

**Specific objectives:**
At the end of this unit the student should be able to:

Solve problems of dynamics by D'Alembert method.

**Learning time:** 10h
- Laboratory classes: 2h
- Guided activities: 2h
- Self study: 6h
7 - Design and analysis of hydraulic and pneumatic systems

Description:
7.1. Pneumatics / hydraulics.
   7.1.1. Concepts and basic characteristics of the two systems.
   7.2 Pneumatic components.
   7.2.1 Work or power elements.
   7.2.2 Operating elements. Valves.
   7.3 Design of basic pneumatic circuits.
   7.4 Design of sequential pneumatic circuits.
   7.5 Simulation of circuits.
   7.6 Hydraulic equipment.
   7.7 Hydraulic circuits.

Related activities:
A1 = Learning evaluation
A2 = Laboratory practices
A3 = Reporting activities

Specific objectives:
At the end of this unit the student should be able to:

- Understand the main elements of a pneumatic system and hydraulic system.
- Know the operation of the oil hydraulic and pneumatic components, its symbolism and interpretation within the different applications.
- Pneumatic and hydraulic circuit design.
- Analyze the performance of pneumatic and hydraulic circuit using a simulation program.
Planning of activities

A1. INDIVIDUAL WRITTEN TESTS

Description:
Training activities for knowledge learning and individual study.

Support materials:
Test set.

Descriptions of the assignments due and their relation to the assessment:
Individual writing or oral resolution of the questions of the test, in a justified way.

Specific objectives:
Assessing the attainment of knowledge and skills specific to the subject.

A2. LABORATORY PRACTICES

Description:
Development of a laboratory experimental work, scheduled and guided by the teacher.

Support materials:
Preparatory reports of the procedures of the laboratory experimental work.

Descriptions of the assignments due and their relation to the assessment:
For each laboratory practice session, the student should provide written proof of the work performed, under the conditions specified in each particular case.

Specific objectives:
The student should be able to:
- Recognize and apply some of the concepts studied in theory activities.
- Explain and describe the phenomena observed in the lab practical.

A3. REPORTING ACTIVITIES

Description:
Working individually or in teams, solving exercises and problems related to the contents of the subject.

Support materials:
Collection of problems and notes of support theory.

Descriptions of the assignments due and their relation to the assessment:
Reasoned resolution of exercises.

Specific objectives:
The student should be able to solve exercises in application of the contents of the subject.

Qualification system

The final grade for the course will be calculated taking into account the following weights for each evaluating act: 70% individual tests to evaluate the learning process (A1), 15% laboratory practices (A2) and 15% reporting activities (A3).
Regulations for carrying out activities

The conditions of realization of each test, will be specified in each particular case, in good time.

Bibliography

**Basic:**


**Complementary:**


