340073 - MECA-D3012 - Mechanics

Coordinating unit: 340 - EPSEVG - Vilanova i la Geltrú School of Engineering
Teaching unit: 712 - EM - Department of Mechanical Engineering
Academic year: 2018
Degree: BACHELOR'S DEGREE IN INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING
(Syllabus 2009). (Teaching unit Compulsory)
ECTS credits: 6
Teaching languages: Catalan

Degree competences to which the subject contributes

Specific:
1. D1. Knowledge of fundamental principals of mechanics of solids rigid 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.

Teaching methodology
The sessions are divided into theory and problems sessions and into laboratory practices. Theory and problem sessions integrate the presentation of the basic theoretical concepts of thematic content of the course, applied examples are described as exercises, and the teacher presents exercises for applying the concepts studied in theory classes and proposes others for resolution by the student, individually or in groups.
In the laboratory practical sessions, experimental tests are developed and is the student, individually or in groups, who must work aspects ruled by the teacher.

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>Total learning time: 150h</th>
<th>Hours large group: 42h</th>
<th>28.00%</th>
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<tbody>
<tr>
<td></td>
<td>Hours medium group: 0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Hours small group: 6h</td>
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<td></td>
<td>Guided activities: 0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Self study: 102h</td>
<td>68.00%</td>
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# Content

<table>
<thead>
<tr>
<th>Section</th>
<th>Learning time:</th>
<th>Description</th>
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</table>
| **1- Mobility of mechanisms** | 10h | Theory classes: 3h  
Laboratory classes: 2h  
Guided activities: 3h  
Self study: 2h  

**Description:**  
1.1 Basic definitions in machines theory  
1.2 Members and kinematic links  
1.3 Types of mechanisms  
1.4 Kinematic scheme of a mechanism  
1.5 Degrees of freedom of a mechanism  
1.6 Position study of a mechanism (with triangles geometry) |
| **2- Equivalent forces systems** | 4h | Theory classes: 2h  
Guided activities: 2h  

**Description:**  
2.1 Basic concepts and definitions  
2.2 Vectorial operations and trigonometry  
2.3 Moment of a force  
2.4 Equivalent systems of forces |
| **3- Mass geometry** | 12h | Theory classes: 4h  
Guided activities: 2h  
Self study: 6h  

**Description:**  
Location of the centre of gravity of a solid. |
## 4 - Statics of rigid bodies

**Description:**

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

**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.

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<tr>
<th>Learning time:</th>
<th>50h</th>
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<tbody>
<tr>
<td>Theory classes:</td>
<td>16h</td>
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<tr>
<td>Guided activities:</td>
<td>4h</td>
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<tr>
<td>Self study:</td>
<td>30h</td>
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## 5 - Kinematics of rigid bodies

**Description:**

Position and velocity analysis in a planar mechanism.

**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.

<table>
<thead>
<tr>
<th>Learning time:</th>
<th>37h</th>
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<tbody>
<tr>
<td>Theory classes:</td>
<td>12h</td>
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<tr>
<td>Guided activities:</td>
<td>3h</td>
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<tr>
<td>Self study:</td>
<td>22h</td>
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</table>
6 - Design and analysis of hydraulic and pneumatic systems

<table>
<thead>
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<th><strong>Description:</strong></th>
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<tr>
<td>6.1. Pneumatics / hydraulics.</td>
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<tr>
<td>6.1.1. Concepts and basic characteristics of the two systems.</td>
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<tr>
<td>6.2 Pneumatic components.</td>
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<tr>
<td>6.2.1 Work or power elements.</td>
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<tr>
<td>6.2.2 Operating elements. Valves.</td>
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<tr>
<td>6.3 Design of basic pneumatic circuits.</td>
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<tr>
<td>6.4 Design of sequential pneumatic circuits.</td>
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<td>6.5 Simulation of circuits.</td>
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<td>6.6 Hydraulic equipment.</td>
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<tr>
<td>6.7 Hydraulic circuits.</td>
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<td><strong>Specific objectives:</strong></td>
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<tr>
<td>At the end of this unit the student should be able to:</td>
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<tr>
<td>- Understand the main elements of a pneumatic system and hydraulic system.</td>
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<td>- Know the operation of the oil hydraulic and pneumatic components, its symbolism and interpretation within the different applications.</td>
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<td>- Pneumatic and hydraulic circuit design.</td>
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<td>- Analyze the performance of pneumatic and hydraulic circuit using a simulation program.</td>
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<th><strong>Learning time:</strong></th>
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<tr>
<td><strong>27h</strong></td>
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<td>Theory classes: 8h</td>
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<tr>
<td>Laboratory classes: 2h</td>
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<tr>
<td>Guided activities: 1h</td>
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<td>Self study : 16h</td>
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**Qualification system**

The final grade for the course will be calculated taking into account the following weights for evaluating act: 67% individual tests to evaluate the learning process (A1), 18% laboratory practices (A2) and 15% reporting activities (A3). There is a reevaluation test that you can present if the grade of the subject is higher than 3 and less than 5, and in which you reevaluate the 67% corresponding to the exams (that is, the 33% corresponding to the evaluation of practices and reports is not reassessable).

The final grade of the subject is calculated with the expression:

\[
N = AC \cdot 0.15 + PR \cdot 0.18 + \max((AP1 \cdot 0.20 + AF \cdot 0.35), AF \cdot 0.55) + AP2 \cdot 0.12
\]

- AC continuous evaluation, reporting activities
- PR laboratory practices
- AP1 partial evaluation about mechanics of rigid body
- AF final evaluation about mechanics of rigid body (this qualification can substitute the AP1 qualification if superior)
- AP2 pneumatic systems evaluation

**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:


