Course guide
320140 - DM - Mechanism Design

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 712 - EM - Department of Mechanical Engineering.
Degree: BACHELOR’S DEGREE IN INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING (Syllabus 2010). (Compulsory subject).

Academic year: 2022  ECTS Credits: 6.0  Languages: Catalan, Spanish

LECTURER

Coordinating lecturer: Albert Català.
Others: Rafael Sitjar.
Catalan Artigas, Albert

PRIOR SKILLS

Students should be complete courses in mechanics systems and Elastic and Strength of materials, even desirable that the student had passed them.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Transversal:
1. 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.
2. 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.
3. ENTREPRENEURSHIP AND INNOVATION - Level 2. Taking initiatives that give rise to opportunities and to new products and solutions, doing so with a vision of process implementation and market understanding, and involving others in projects that have to be carried out.
4. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.

TEACHING METHODOLOGY

Students should be complete courses in Mechanics Systems and Elastic and Strength of materials, even desirable that the student had passed them.

LEARNING OBJECTIVES OF THE SUBJECT

To know and to understand all the concepts learnt in Mechanics Systems and Elastic and Strength of materials.
To solve kinematic and dynamic problems
STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Hours large group</td>
<td>30,0</td>
<td>20.00</td>
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<tr>
<td>Hours small group</td>
<td>30,0</td>
<td>20.00</td>
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<tr>
<td>Self study</td>
<td>90,0</td>
<td>60.00</td>
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Total learning time: 150 h

CONTENTS

**TOPIC 1: Introduction and degrees of freedom**

**Description:**
- Introduction to the study of the mechanisms
- Nomenclature used.
- Definition of basic mechanical elements.
- A combination of mechanical elements.
- Degrees of freedom definition
- Application of mechanical principles.
- Calculation criteria mechanisms plan.
- Application.

**Related activities:**
- Terminology normally used
- Conventions used
- Schematic representation
- Determine mobility mechanisms

**Full-or-part-time: 4h**
Theory classes: 2h
Practical classes: 2h

**TOPIC 2: Inverse Kinematics**

**Description:**
- Concept.

**Full-or-part-time: 4h**
Theory classes: 2h
Practical classes: 2h
### TOPIC 3: Mechanisms Description

**Description:**
- Classification
- Composition
- Geometric limitations
- Trajectories
- Deadlocks
- Equations of motion

**Full-or-part-time:** 4h  
Theory classes: 2h  
Practical classes: 2h

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### TOPIC 4: Velocities and accelerations

**Description:**
- Reference systems
- Graphic Analysis
- Vector calculus
- Mechanisms with and without sliding

**Full-or-part-time:** 4h  
Theory classes: 2h  
Practical classes: 2h

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### TOPIC 5: Forces and couples in machines

**Description:**
- External forces
- External moments
- Internal forces
- Moments of Inertia
- Reduced mass

**Full-or-part-time:** 4h  
Theory classes: 2h  
Practical classes: 2h

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### TOPIC 6: Balance of Mechanisms

**Description:**
- Mass balance in a common radial plane
- Mass balance in a common axial plane
- General situation
- Alternative masses balance

**Full-or-part-time:** 4h  
Theory classes: 2h  
Practical classes: 2h
## TOPIC 7: Regulation of mechanisms

**Description:**
- Grades of irregularity
- Calculating the flywheel
- Equivalent inertia of mechanisms
- Location of the flywheel
- Starting torque

**Full-or-part-time:** 4h  
Theory classes: 2h  
Practical classes: 2h

## TOPIC 8: Stress state

**Description:**
- Definition
- Simple stress state
- Distribution of stresses in the interior parts
- Representation of the stress state
- Principal stresses
- Mohr Circle

**Full-or-part-time:** 4h  
Theory classes: 2h  
Practical classes: 2h

## TOPIC 9: Breaking theories

**Description:**
- Definition and limitations
- Safety factor
- Theory of the maximum normal stress
- Theory of the maximum tangential stress
- Theory of the maximum energy of distortion
- Applications

**Full-or-part-time:** 4h  
Theory classes: 2h  
Practical classes: 2h

## TOPIC 10: Fatigue of materials I

**Description:**
- Wöhler tests Machine
- Finite life and infinite life
- Soderberg and Goodman diagrams

**Full-or-part-time:** 4h  
Theory classes: 2h  
Practical classes: 2h
<table>
<thead>
<tr>
<th>TOPIC 11: Fatigue of materials II</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
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<tr>
<td>· Coefficients that modify the fatigue strength</td>
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<tr>
<td>· Soderberg and Goodman diagrams</td>
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<tr>
<td>· Determination of the equations</td>
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<td><strong>Full-or-part-time:</strong> 4h</td>
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<td>Theory classes: 2h</td>
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<tr>
<th>TOPIC 12: Machines elements</th>
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<tr>
<td><strong>Description:</strong></td>
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<tr>
<td>· Calculation of axis</td>
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<tr>
<td>· Calculation of bolted joints</td>
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<tr>
<td><strong>Full-or-part-time:</strong> 4h</td>
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<th>TOPIC 13: Activities done in a company</th>
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<td><strong>Description:</strong></td>
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<tr>
<td>· Practical case about the analysis of a mechanical project</td>
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<td>· The mechanical analysis tools</td>
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<td><strong>Full-or-part-time:</strong> 4h</td>
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<th>TOPIC 14: Activities done in a company</th>
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<tr>
<td><strong>Description:</strong></td>
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<tr>
<td>· Practical case about designing a mechanical project</td>
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<td><strong>Full-or-part-time:</strong> 4h</td>
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<td>Theory classes: 2h</td>
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<th>TOPIC 15: Activities done in a company</th>
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<td>· Practical case about the analysis of a mechanical project</td>
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<td><strong>Full-or-part-time:</strong> 4h</td>
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<tr>
<td>Theory classes: 2h</td>
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GRADING SYSTEM

- Exam 1: 25%
- Exam 2: 25%
- Exam 3: 25%
- Exam 4: 25%

For those students who meet the requirements and submit to the reevaluation examination, the grade of the reevaluation exam will replace the grades of all the on-site written evaluation acts (tests, midterm and final exams) and the grades obtained during the course for lab practices, works, projects and presentations will be kept.

If the final grade after reevaluation is lower than 5.0, it will replace the initial one only if it is higher. If the final grade after reevaluation is greater or equal to 5.0, the final grade of the subject will be pass 5.0.

BIBLIOGRAPHY

Basic: