820458 - EMQM - Machine Elements

Coordinating unit: 295 - EEBE - Barcelona East School of Engineering
Teaching unit: 712 - EM - Department of Mechanical Engineering
Academic year: 2016
Degree: BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)
ECTS credits: 6
Teaching languages: Catalan, Spanish, English

Prior skills
Knowledge of mechanics and strength of materials.

Degree competences to which the subject contributes

Transversal:
1. EFFECTIVE USE OF INFORMATION RESOURCES - Level 3. Planning and using the information necessary for an academic assignment (a final thesis, for example) based on a critical appraisal of the information resources used.

Teaching methodology
Oral explanation of concepts, principles and calculation methods. Discussion of case studies when appropriate.

Course Description: The methods developed in statics, dynamics, and strength of materials are applied to the selection of basic machine components. The fundamental principles required for the selection of individual elements that compose a machine are developed.

Learning objectives of the subject
1. Students will be able to design machine elements and systems of machine elements to successfully satisfy the function of the machine.
2. Students will be able use a written format to communicate engineering designs in a professional manner.
3. Students will be able to apply principles of engineering, basic science and mathematics to model, analyze, design and realize physical systems, components or processes, and work professionally in mechanical areas.
### 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></td>
<td>150h</td>
<td>45h</td>
<td>0h</td>
<td>15h</td>
<td>90h</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **45h** (30.00%)
- **0h** (0.00%)
- **15h** (10.00%)
- **0h** (0.00%)
- **90h** (60.00%)
# Content

## Introduction to mechanical design

### Learning time: 15h
- Theory classes: 6h
- Guided activities: 7h
- Self study: 2h

### Description:
Introduction to the design concept and its role in the design of mechanical elements. Introduction to the design tree: Recognition of need -> Definition of the problem -> Summaries -> Analysis -> Improvement and Optimization -> Evaluation -> Presentation.

### Related activities:
Case presentation can clearly see where each of the phases described in the previous section and evaluate the importance from the different views of each stage.

### Specific objectives:
The student must be able to describe and recognize each stage of design.

## Machine Design: An Introduction and methodologies.

### Learning time: 15h
- Theory classes: 6h
- Guided activities: 2h
- Self study: 7h

### Description:
Apply the design concept to the field of machines and have different working methods conducive to solving the design. Be presented alternative assessment tools, modeling and analysis, and process documentation.

### Related activities:
On a case students have to work different design alternatives and make an assessment.

### Specific objectives:
The student must be able to use different methodologies presented and evaluate the results.

## Design of a subset of a machine.

### Learning time: 15h
- Theory classes: 6h
- Guided activities: 2h
- Self study: 7h

### Description:
Apply prior knowledge to cough on a known case where the subset is sufficient knowledge to be able to vary the design and qualitatively recognize his goodness.

### Related activities:
Re-designing a subset of a machine, simple and known, and qualitatively verify the result, so will have to use the techniques described so far in the subject.

### Specific objectives:
The student should be able to complete the redesign of a subset and improvements made to establish them.
### Standard elements

<table>
<thead>
<tr>
<th>Learning time: 15h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 6h</td>
</tr>
<tr>
<td>Guided activities: 2h</td>
</tr>
<tr>
<td>Self study: 7h</td>
</tr>
</tbody>
</table>

#### Description:
The most common standard elements in mechanical design will be presented. The economic importance and use of standard elements will be assessed.

#### Related activities:
There will be a simple design with the use of standard elements and without them, then assess the efficiency of its use. Remember its graphical representation.

#### Specific objectives:
The student must be able to recognize, choose and assess the common standard in the projects listed are in mechanical design projects, and to ensure a correct representation of the same. The use of commercial information in an appropriate manner for the student is expected.

### Lubrication and bearings

<table>
<thead>
<tr>
<th>Learning time: 15h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 6h</td>
</tr>
<tr>
<td>Guided activities: 2h</td>
</tr>
<tr>
<td>Self study: 7h</td>
</tr>
</tbody>
</table>

#### Description:
The lubrication concepts and its importance in the machine functionality will be introduced. Introduction of: lubrication, wear and friction, and bearings. Within this section shall state the use of environmental legislation in this field.

#### Related activities:
Through a group project, the student will select the coupling system between pieces on relative motion and contact. Must reduce friction to levels of design and it must select a type of lubricant and suitable bearings.

#### Specific objectives:
The student must be able to select a lubricant and lubrication method in the field of machine design and must be able to select bearings that are most appropriate for the description of the problem. The use of commercial information in an appropriate manner for the student is expected.
### Bearings

**Description:**
Will present the coupling system based on your custom bearings and reduce the friction between mobile systems. Will be presented the way you work as resistant mechanism and what are the efforts that request.

**Related activities:**
The student will design a system of coupled shaft-hub commercial catalogs and select the best solution for it.

**Specific objectives:**
The student must be able to select bearings, analyze the forces and movements must support that should be restricted. The use of commercial information in an appropriate manner for the student is expected.

<table>
<thead>
<tr>
<th><strong>Learning time:</strong> 15h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 6h</td>
</tr>
<tr>
<td>Guided activities: 7h</td>
</tr>
<tr>
<td>Self study: 2h</td>
</tr>
</tbody>
</table>

### Design of threaded joints

**Description:**
Will present the system of threaded fasteners, screw types, efforts suffer these unions and comparison with other types of joints fixed, removable or not.

**Related activities:**
The student will design different screw connections, depending on the loads to be supported, the different types of materials to be bonded and how to work in the union.

**Specific objectives:**
The student must be able to design and verify a threaded connection and mechanically design elements that comprise it, screws, washers and females. The use of commercial information in an appropriate manner for the student is expected.

<table>
<thead>
<tr>
<th><strong>Learning time:</strong> 15h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 6h</td>
</tr>
<tr>
<td>Practical classes: 2h</td>
</tr>
<tr>
<td>Self study: 7h</td>
</tr>
</tbody>
</table>
### Spring design

**Learning time:** 15h  
Theory classes: 6h  
Practical classes: 2h  
Self study (distance learning): 7h

**Description:**  
Calculation of springs, compression and torsion, will be presented.

**Related activities:**  
The student analyzed on a case the possible variants as regards the use of springs.

**Specific objectives:**  
The student must be able to design the different types of springs described and selecting appropriate materials for their manufacture. The use of commercial information in an appropriate manner for the student is expected.

### Selecting electric motors

**Learning time:** 15h  
Theory classes: 6h  
Guided activities: 2h  
Self study: 7h

**Description:**  
Will present different types of electric motor, a daily basis which are used as drive machine. Without going into details of the electric and magnetic design will explain the mechanical principle of operation. Also present the union of a motor and gearbox.

**Related activities:**  
Given the usual parameters for selecting an electric motor, the student must select one engine between different commercial catalogs.

**Specific objectives:**  
The student must be able to select an electric motor or a geared motor from a catalog business and therefore must be able to make appropriate use of commercial information that will be presented.
European Directive on machines

<table>
<thead>
<tr>
<th>Learning time: 15h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 6h</td>
</tr>
<tr>
<td>Guided activities: 2h</td>
</tr>
<tr>
<td>Self study: 7h</td>
</tr>
</tbody>
</table>

Description:
Will present the legal framework of the European Union with regard to industrial machinery, the machinery directive and harmonized standards in force.

Related activities:
To ensure understanding and implementation capacity of the legislation in the field, propose different activities where they need to assess the implementation of regulations, which have to solve the formal part of the delivery of materials and a summary of standards activity effect for areas within the treated field.

Specific objectives:
The student must be able to apply the existing regulatory framework for projects of the course, see what rules will apply. The use of legal information for the student is expected.

Degree competences to which the content contributes:

Qualification system

Combined Tests/Examinations: 40% Tests will include problems and short answer questions.
Homework/Quizzes/Extra Credit: 30% Homeworks will be assigned each week.
Final Exam: 25%
5% Evaluation of specific skill.

Regulations for carrying out activities

a) Assignments must be submitted at the beginning of class on the assigned due date. No late homework will be accepted.
b) Discussions of assignments with other students is encouraged and permitted; however, all homework and design project work turned in should represent the own student effort.
c) Homework should be done on DINA4 engineer0s paper and identified by: EMQ, course, student name, homework number and date. Computer printouts for homework solutions are accepted.
d) The group members must sign the group assignments (projects).

Bibliography