Course guide
330516 - RM - Material Resistance

Unit in charge: Manresa School of Engineering
Teaching unit: 750 - EMIT - Department of Mining, Industrial and ICT Engineering.

Degree: BACHELOR'S DEGREE IN AUTOMOTIVE ENGINEERING (Syllabus 2017). (Compulsory subject).

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

LECTURER

Coordinating lecturer: Torrelles Rico, Jordi Josep
Others: Torrelles Rico, Jordi Josep

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CE12. Knowledge and use of materials resistance principles and ability to calculate structures of a vehicle.

General:
CG1. Ability to write and develop projects in the field of automotive engineering for the construction, renovation, repair, maintenance, recycling, manufacture, installation, assembly or operation of: structures, mechanical equipment, energy installations, electrical and electronic installations, plants and industrial plants and manufacturing and automation processes.
CG2. Capacity for management of the activities that are the subject of the engineering projects described in the previous section.
CG3. Knowledge of basic and technological subjects that will enable students to learn new methods and theories and that will endow them with the versatility needed to adapt to new situations.
CG4. Ability to solve problems with initiative, decision-making, creativity, critical reasoning and to communicate and transmit knowledge, skills and skills in the field of automotive engineering.
CG7. A capacity for analysing and assessing the social and environmental impact of technical solutions.

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.
2. 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.

Basic:
CB3. That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include a reflection on relevant social, scientific or ethical issues.
CB4. Students can transmit information, ideas, problems and solutions to a specialized and non-specialized audience.

TEACHING METHODOLOGY

MD1 Master class or conference (EXP)
MD2 Problem solving and case study (RP)
MD3 Practical laboratory or workshop assignments (TP)
MD7 Project or Extended Work (PA)
LEARNING OBJECTIVES OF THE SUBJECT

The course aims to provide basic knowledge about the resistance of materials.

The different learning objectives include:
- Know the characteristics of the different efforts, stresses and deformations
- Know and apply the mathematical relationships between these mechanical variables: Calculate the stresses and stresses in a structure.
- Know and apply the different techniques of structural analysis that derive from the knowledge of the resistance of materials.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>30,0</td>
<td>20.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>30,0</td>
<td>20.00</td>
</tr>
<tr>
<td>Self study</td>
<td>90,0</td>
<td>60.00</td>
</tr>
</tbody>
</table>

Total learning time: 150 h

CONTENTS

Subject 1: Introduction to strength of materials

Description:
Concept of stress and strain. Elasticity and behavior of materials.

Specific objectives:
Understanding and analysis of the concepts of stress and deformation, and of the behavior of materials subjected to stress.

Related activities:
Specific work on the contents (Activity 1)

Full-or-part-time: 20h
Theory classes: 4h
Laboratory classes: 4h
Self study: 12h

Subject 2: Traction and compression

Description:
Traction and compression forces.

Specific objectives:
Understanding, analysis and application of tensile and compression forces, the stresses and deformations that cause and knowing how to calculate elongations and decreases of parts subjected to this stress.

Related activities:
Specific work on the contents (Activity 2)

Full-or-part-time: 20h
Theory classes: 4h
Laboratory classes: 4h
Self study: 12h
Subject 3: Bending stresses

**Description:**
Bending stresses.

**Specific objectives:**
Understanding, analysis and application of bending stresses, stresses and deformations that cause and knowing how to calculate stresses and stresses in parts subjected to this stress.

**Related activities:**
Specific work on the contents (Activity 3)
Specific work on the contents (Activity 4)

**Full-or-part-time:** 60h
Theory classes: 12h
Laboratory classes: 12h
Self study: 36h

Subject 4: Shear and torsion

**Description:**
Shear and torsion forces.

**Specific objectives:**
Understanding, analysis and application of torsional and shear stresses, stresses and deformations that cause and knowing how to calculate stresses and efforts of parts subjected to this stress.

**Related activities:**
Specific work on the contents (Activity 3)
Specific work on the contents (Activity 4)

**Full-or-part-time:** 50h
Theory classes: 10h
Laboratory classes: 10h
Self study: 30h
### Activity 1: Introduction to strength of materials. Practices in the computer class.

**Description:**
Numerical modeling is introduced using specific finite element software, to introduce the basic concepts of Strength of Materials, focusing on aspects related to structures in the automotive sector. You must deliver a document that collects the aspects worked. It takes place in the school’s computer rooms.

**Specific objectives:**
- Development of reasoning techniques and strategies for analysis
- Written communication
- Teamwork
- Solvent use of information resources
- Social commitment and sustainability
- Innovation

**Material:**
On the “ATENEA” virtual campus
Specific software with free license for students.

**Delivery:**
- 10 % of the mark
- **Full-or-part-time:** 9h
  - Theory classes: 1h
  - Self study: 8h

### Activity 2: Traction and compression forces

**Description:**
Evaluation by examination.

**Specific objectives:**
Partial exam to verify that the knowledge of the syllabus has been assimilated.

**Material:**
On the “ATENEA” virtual campus

**Delivery:**
- 35 % of the mark
- **Full-or-part-time:** 16h
  - Theory classes: 2h
  - Self study: 14h
Activity 3: Practices in the computer class.

Description:
Practical learning on numerical modeling with specific finite element software, to reinforce the concepts of Resistance of Materials worked, focusing on aspects related to structures in the automotive sector. A document must be delivered that includes the aspects worked on.
It takes place in the computer class.

Specific objectives:
Development of reasoning techniques and strategies for analysis
Written and oral communication
Teamwork
Solvent use of information resources
Social commitment and sustainability
Innovation

Material:
In the virtual campus "ATENEA"
Free licensed software for students.

Delivery:
10% of the grade

Full-or-part-time: 9h
Theory classes: 1h
Self study: 8h

Activity 4: Bending, shear and torsion stresses

Description:
Evaluation by examination.

Specific objectives:
Partial exam to verify that the knowledge of the syllabus has been assimilated.

Material:
In the virtual campus "ATENEA"

Delivery:
35% of the grade

Full-or-part-time: 17h
Theory classes: 2h 30m
Self study: 14h 30m

GRADING SYSTEM
Activity 1: 10 % mark
Activity 2: 35 % mark
Activity 3: 10 % mark
Activity 4: 35 % mark
Class attendance and participation: 10 % mark

EXAMINATION RULES.
It is essential to have attended 70 % of the classes in order to pass the course.
BIBLIOGRAPHY

Basic:

Complementary:

RESOURCES

Other resources:
On the "ATENEA" virtual campus