

Course guide

330516 - RM - Material Resistance

Last modified: 04/05/2023

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: 2023 **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.

Generical:

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

Type	Hours	Percentage
Hours large group	30,0	20.00
Self study	90,0	60.00
Hours small group	30,0	20.00

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



ACTIVITIES

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:

- Rivera Amores, Juanjo. Anàlisi d'estructures: teoria i problemes [on line]. Barcelona: Edicions UPC, 2005 [Consultation: 06/11/2020]. Available on: <http://hdl.handle.net/2099.3/36638>. ISBN 8483018179.
- Goodno, Barry J; Gere, James M. Mechanics of materials. Ninth edition, SI. Boston: Cengage Learning, 2018. ISBN 9781337093354.
- Hibbeler, R. C. Mechanics of materials. Singapore: Prentice Hall, 2011. ISBN 9789810685096.
- Beer, F. P.; Johnston, E. R.; Dewolf, J. T. Mechanics of materials [on line]. 7th ed. Boston: McGraw-Hill, 2012 [Consultation: 14/09/2022]. Available on: https://www.ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=12751. ISBN 9780073398235.

Complementary:

- Bickford, W. B. Mecánica de sólidos: conceptos y aplicaciones. Baltimore: Irwin, 1995. ISBN 8480861703.

RESOURCES

Other resources:

On the "ATENEA" virtual campus