



PERSONA CIÈNCIA EMPRESA  
Universitat Ramon Llull

## TITLE OF COURSE: MATERIALS RESISTANCE

**MATTER:** Fundamentals of Science and  
Technology of Materials

**MODULE:** Common to Industry Branch

**PROGRAM TITLE:** Degree on Industrial  
Technologies Engineering

### GENERAL CHARACTERISTICS\*

**Type:**  Basic training,  Compulsory elective,  Optional  
 Final degree project,  Practicum

**Duration:** Semiannual

**Semester/s:** 4

**Number of credits ECTS:** 5

**Language/s:** Spanish, Catalan, English

### DESCRIPTION

**BRIEF DESCRIPTION AND JUSTIFICATION** (the meaning of the course in relation to the studies. Between 100 and 200 words.)

This course provides students with the ability to determine which efforts is under a structural element, the respective tensions, the strains and displacements in these elements, thus laying the foundations require calculating machines and structures. We contemplate the concepts of Strength, Stiffness and Stability structural concepts extremely important in field of industrial engineering. The Strength of Materials not cover all problems of mechanics of deformable solid, complemented by more disciplines detail this issue. However, it plays a fundamental role to position properly before the structural

**COMPETENCES** (of the course made in relation to preassigned competences in this area.)

- Understand and apply basic knowledge of mathematics, physics, mechanical and materials engineering practice in industry (E1, E 2).
- Be able to solve problems with initiative, decision making, creativity and critical reasoning (E4).
- Acquire ability to develop, plan and implement analytical methods and Numerical modeling for mathematicians in the field of engineering industrial (E7).
- Ability to acquire skills to communicate effectively (oral and written) to impart knowledge and skills in the field of engineering industrial (T1).
- Ability to acquire knowledge and know how to use the principles of resistance Materials (CRI 8).

**PREREQUISITES\*** (modules, matters, courses and knowledge needed to follow the course. Can be stated that courses must have been completed.)

Subjects studied previously: Applied Mechanics

General knowledge of differential calculus, integral calculus, analysis internal efforts and reactions isoestatic system.

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**CONTENTS** (as a relationship of the chapters that constitute the contents, or topics covered, of the course to a second level detail.)

**1. The elastic solid.**

Introduction to solid deformable. Concept of stress. Concept of deformation. Elasticity linear. Failure criteria. Basic assumptions of the Strength of Materials.

**2. Efforts Diagrams**

Isoestáticos dimensional systems. Space systems.

**3. The tensile stress and compression. cut**

Axial tension and compression. State axial stress and strain. indeterminate problems Axial. Pure shear stress. Bolted and welded.

**4. Bending theory**

Pure bending. Axial stresses produced by bending stress.

**5. shear**

Shear stresses in beams due to shear.

**6. Torsion Theory**

Shear stresses and strains in beams due to torque.

**7. Generalized displacements. energy theorems**

Differential equation of the elastic. Mohr Theorems.

**8. combined loads**

Combined bending. A neutral axis section. Flexion diverted.

**9. Influence Lines**

Influence lines for reactions and efforts prismatic parts.

### METHODOLOGY

**TRAINING ACTIVITIES\*** (Complete the table relating activities, workload in ECTS credits, and competences.)

Training activities	ECTS Credits	Competences
Sessions presentation of concepts, resolution of exercises, problems and cases (A2) (A1)	1,4	E1, E2, CRI 8
Seminars (A3)	0,1	E1, E2, CRI 8
Personal mandatory activities professor-student (A4)		
Practical work / laboratory (A5)	1	E1, E2, E7, T1, CRI 8
Personal study activities by students (A7)	2	E1, E2, T1, CRI 8
Evaluation activities (exams, tests,...) (A8)	0,3	E1, E2, CRI 8
Jobs (A9)	0,2	E1, E2, E4, CRI 8, T1
Visits to companies (A10)		

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<b>TOTAL</b>	<b>5</b>	
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**EXPLANATION OF THE TEACHING METHODOLOGY** (justifying the teaching methods used in relation to the competences and course contents. Between 100 and 200 words.)

The development methodology is done through lectures, supplemented with classes, where situations related to the Resistance Materials. Some of these situations are based on real cases. Students, in turn, must complete training to solve problems individually, from dossier and the available hours of consultation with the teacher. It then acquires knowledge and practice of participatory in each of these parts.

Referring sessions, develops learning about virtual lab (Finite Element Software MEF) from a file and monitored individually by the teacher (work computer). Emphasis is placed on the stage analysis of a real problem. In the case of physical laboratory, it is experiences prismatic piece of structural modules (Extensometry) and experiences through the use of a universal machine, developed in groups reduced dossier and consultation with teachers.

### EVALUATION

**EVALUATION METHODS\*** (Fill in the table relating evaluation methods, competences and weight in the qualification of the subject.)

<b>Evaluation Methods</b>	<b>Weight</b>	<b>Competences</b>
Final Exam (A)	42%	E1, E2, CRI 8
Examination / s Partial / s / control / s scheduled / s (B)	18%	E1, E2, CRI 8
Activities done in class (C)	2%	E2, CRI 8
Exercises outside of class (D)	2%	E2, CRI 8
Reports realizats work (E)	5%	E2, CRI 8
Presentations and / or oral examinations (F)	1%	T1, CR 8
Modeling, Proposed, etc.. (G)	6%	E4, E7
Laboratory reports (H)	8%	E2, E7, T1, CRI 8
Practical work / lab (I)	15%	E2, E7, CRI 8
Work in other centers (Practicum) (J)	-	
Participations (K)	1%	E7, T1

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**LEARNING OUTCOMES** (Explanation of the achievements of students that allow competences evaluation, relating to competences and evaluation methods.)

- The student must demonstrate the ability to interpret and analyze physical concepts related to linear behavior of structures, components and products from the perspective of Strength of Materials (E1, E2, E4, E7, CRI 8) (A, B, C, D, E, F, G, H, I, K).
- The student must show ability to calculate structures, component and usually required under linear behavior and present basic knowledge in nonlinear field (E1, E2, E4, E7, CRI 8) (A, B, C, D, E, F, G, H, I, K).

**QUALIFICATION** (Explanation of the calculation system of qualifying the course.)

We calculate the final grade for the course, in base 10, as follows, taking into account each of the activities (60% Exams and continuous monitoring, activities continuous 5% Laboratory 35%):

Note  $A + BC = 0.6 \cdot \dots + A 0.05 0.35$

Note: Note for the course

A: Score final exam and continuous monitoring.

AC: Score by continuous activities.

A: Score in associated laboratory activities.

The exam will be calculated and controlled by the best of two options:

Option 1: Note final exam EF.

$A1 = EF$

Option 2: Average final exam weighted average EF and four controls C.

$$C = \frac{C1 + C2 + C3 + CP}{4}; \quad CP = \frac{CP1 + CP2 + CP3}{3}$$

$$A2 = 0,65 \cdot EF + 0,35 \cdot C$$

$A2 = 0.65 + 0.35 \cdot \cdot C EF$

Ci: Controls up course

CPI: Controls practices

CP: Media Control Practices

C: Average total control of the subject

By using average formula, the exam grade A (option A1 or A2) must be equal to or greater than 4.5.

Demand also, with average formula, which controls the note C is equal to or greater than 4.

The note continued AC activity is calculated as the average of the activities proposals.

The practical is obtained as the weighted average of the different activities laboratory. This result must be 4.5 or above to pass the course. If any of the aforementioned parties to demand value 4.5 or 4 shall not exceed the rating, the final grade for the course will be the lesser of these grades (A or C or AL). It is mandatory to present a high level of care (about

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80%) for passing the subject. An attendance lower than indicated, without just cause, directly involves the suspension of schooling in this subject.

**EVALUATION OF COMPETENCES** (Defining expressions of calculation for each competence based on corresponding evaluations activities.)

For the evaluation of competencies E1, E2, E4, E7 and 8 CRI will be used as an indicator of the final course.

### **TEXTBOOKS** (recommended and accessible to students.)

- ORTIZBERROCAL, L. "*Resistencia de Materiales*". Ed. McGraw-Hill. Madrid, 1991
- ORTIZ BERROCAL, L. "*Elasticidad*". Ed. McGraw-Hill. Madrid, 1998
- TIMOSHENKO, S. "*Resistencia de Materiales*". Ed. Espasa-Calpe. Madrid, 1946
- TIMOSHENKO, S.P. y GERE, J.M. "*Mecánica de Materiales*". Grupo Editorial Iberoamericano. México D.F., 1986
- TIMOSHENKO y YOUNG. "Teoría de las Estructuras" Bilbao, URMO, 1981

### **HISTORICAL DOCUMENT**

#### **EARLIER CHANGES**

February 27, 2011, Josep Maria Puigoriol Forcada

February 11, 2012, Josep Maria Puigoriol Forcada

#### **LAST REVISION**

July 17, 2012, Josep Maria Puigoriol Forcada

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