ISEL
INSTITUTO SUPERIOR DE ENGENHARIA DE LISBOA

DEC
ÁREA DEPARTAMENTAL DE ENGENHARIA CIVIL

Course file

Study cycle	BACHELOR IN CIVIL ENGINEERING		
Course	Strengths of Materials I (RM I)	Mandatory	☒
		Optional	☐
Course scientific area	CIVIL ENGINEERING	Category	C

Course category: B - Basic; C - Core Engineering; E - Specialization; P - Complementary.

Year: 2nd	Semester: 3rd		ECTS: 5,5		Total: 148
Contact time	T: 45	TP: 22,5	PL:	S:	OT:

T - Lectures; TP - Theory and practice; PL - Lab Work; S - Seminar; OT - Tutorial Guidance.

Course Director	Title	Position
Eunice Ramos Craveiro Antunes	Licenciado	Professor Adjunto

Learning objectives (knowledge, skills and competences to be developed by students)

(max. 1000 characters)

To provide to the students the basic elements of resistance of materials, allowing them to comprehend the knowledge acquired, when confronted with the reality of the structural situations, in the professional life.

Straight axis bars dimension, considering as a limit the values of the maximum admissible tensions to the traction and to the compression; and of the maximum shear stresses in bending.

Syllabus

(max. 1000 characters)

1. Axial Loading - Concept of Stress and Strain. Saint-Venant's Principle. Hooke's Law. Design considerations. Poisson's ratio. Effect of temperature changes. Stress-strain diagram of steel.

2. Stresses and strains to statically indeterminate bending; Effect of self-weight and temperature changes.

3. Shear - Stresses distortions and displacements. Hooke's Law. Distortion modulus.

4. Directional Plane Stress Analysis. Uniaxial and biaxial stress conditions. Condition of pure shear. Mohr's Circle.

5. Pure Torsion in beams. Shear stresses and distortions for beams in torsion.

6. Bending moment - Bending Simple Plane. Navier's Hypothesis. Elastic section modulus - design of beams.

Shearing stresses. Principal stresses. Eccentric axial loading in a plane of symmetry. Unsymmetrical bending. General cases of eccentric axial loading. Relationship between position of load and neutral axis. Core of a cross section.

7. Analysis and design of beams for bending.

Demonstration of the consistency between the syllabus and the course objectives

(max. 1000 characters)

The study of the elementary forces caused by external actions, in terms of stresses and strains, thus depending on the type of sections and structures, allows the student to interpret constructive processes, such as section placing reinforcement and the existence of expansion joints.

The diversity of dimensions studied, taking into account the admissible stress values and relating the maximum forces with structure length, prepares the student with the basics for pre-dimensioning of the structural element sections (sabots, beams and pillars). It also allows the dimensioning of isostatic structures, formed by metallic or wooden profiles.

Teaching methodology (evaluation included)

(max. 1000 characters)

The topics are lectured in theoretical and TP lessons. The audio-visual materials available are used as complementary means for teaching. In TP lessons, real life examples are illustrated and theoretical topics are applied with practical exercises.

The lectures are complemented by two course booklets, one with theory and the second one with solved exercises.

The students are graded individually, through a global exam and statutory exams.

The exams are divided into two parts, a theoretical part worth 5 points and a practical part worth 15 points.

Demonstration of the consistency between teaching methodology and the course learning objectives

(max. 3000 characters)

During theoretical lessons, the students are lectured the basic concepts of mechanics of materials, which allow them to comprehend the subjects of the following semesters' courses.

During TP lessons, the students are presented with real life examples illustrations on the dimensioning of shaft sections of straight bars and structural phenomena, which the students will be faced with in their

professional lives.

Main Bibliography

(max. 1000 characters)

Beer, F. P, Johnston Jr., E. R., DeWolf, J. T. and Mazurek, D.F. (2011), Mechanics of Materials, 5 ed., AMGH / McGraw-Hill do Brasil, São Paulo, SP.

Popov, E.P. (1984), Mechanics of Materials, 2 ed, Prentice-Hall do Brasil Ltda, Rio de Janeiro, RJ

Willems, N., Easley, J.T. and Rolfe, S.T. (1983). Strength of Materials, McGraw-Hill do Brasil, São Paulo, SP

Hibbeler, R.C.(2010), Mechanics of Materials,7 ed., Pearson Prentice Hall, São Paulo, SP

Ugural, A.C. (2009), Mechanics of Materials, 1 ed. LTC, Rio de Janeiro, R.J.