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Course Unit	Strength of Materials II			Field of study	Mechanics of Materials and Structural Concrete		
Bachelor in	Civil Engineering			School	School of Technology and Management		
Academic Year	2023/2024	Year of study	2	Level	1-2	ECTS credits	6.0
Type	Semestral	Semester	1	Code	9089-322-2105-00-23		

Workload (hours)	162	Contact hours	T	30	TP	30	PL	-	TC	-	S	-	E	-	OT	-	O	-

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s)	Pedro Nuno Gonçalves Nogueiro

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:
1. Design the sections in symmetric bending and shear.
2. Found the tensions distributions, due to the shear stress.
3. Knows the meanings of unsymmetrical bending, mainly neutral axis, eccentrically axial loading, determination of the normal stresses, core of the cross-section.
4. Determination of the section tension composed with two different materials.
5. Torsion, angle of torsion, Shear stresses.
6. Study the Deflection of beams.
7. Understand the stability of Structures.

Prerequisites

Before the course unit the learner is expected to be able to:
1. Found the reactions of simply-supported beams.
2. Understand the behaviour of the isotropic materials.

Course contents

Symmetrical bending, Unsymmetrical bending, Torsion, Deflection of beams, Stability of Structures

Course contents (extended version)

1. Chap. I Study of the distribution of the linear sections in bending.
   - Shear stress in symmetrically loaded beams. Shear stresses txy. Shear stresses txz. Shear center.
2. Chap. II Bending and axial loading.
   - Normal stresses. Neutral axis. Core of the cross-section. Bending of the composed cross-sections.
3. Chap. III Torsion.
   - Solid circular shaft, hollow shaft, noncircular, rectangular and thin-walled hallow shaft. .
4. Chap. IV Deflection of beams by integration.
   - Equation of the elastic curve. Integration of the equation of elastic curve. Clebsch's method.
5. Chap. V Stability of structures.
   - Critical loads. Euler's formula. Other end conditions. Design of columns according Eurocode 3 (EC3).

Recommended reading

1. "Mecânica e Resistência dos Materiais". Vitor Dias da Silva, 3. ª edição, ed: Zuari - Edição de Livros Técnicos, Lda,
2. "Mecânica dos Materiais". Carlos Moura Branco, McGrawHill.
3. "Estabilidade Estrutural". António Reis, Dinar Camotim, Mc Graw-Hill, 2000.

Teaching and learning methods

The unit will be taught using a combination of two hours of theorectical lectures and two hours of practical lectures, self guided learning. Practical exercices will be done in bases of the recommended literature.

Assessment methods

1. Alternative 1 - (Regular, Student Worker) (Final, Supplementary, Special)
   - Final Written Exam - 100%
2. Alternative 2 - (Regular, Student Worker) (Final)
   - Intermediate Written Test - 20%
   - Final Written Exam - 70%

Language of instruction

Portuguese

Electronic validation

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03-10-2023	04-10-2023	10-10-2023	20-10-2023