INSTITUTO POLITÉCNICO DE BRAGANÇA

Course Unit	Structural Analysis I			Field of study	Mechanics of Materials and Structural Concrete		
Bachelor in	Civil Engineering			School	School of Technology and Management		
Academic Year	2022/2023	Year of study	2	Level	1-2	ECTS credits	6.0
Type	Semestral	Semester	2	Code	9089-322-2201-00-22		

Workload (hours)	162	Contact hours	T -	TP 60	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): Debora Rodrigues de Sousa Macanjo Ferreira

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:
1. Study the principles of behavior of reticulate structures and apply the force method to calculate these structures
2. Study and apply the influence line concept
3. Actions and combination of actions

Prerequisites

Before the course unit the learner is expected to be able to:
1. Analyse statically determinate continuous structures
2. Obtain the internal forces and diagrams

Course contents

Force method. Energy theorems: application on structural analysis. Influence lines. Symmetry simplification in hyperstatic structures. Actions and combination of actions

Course contents (extended version)

1. Chapter 1 - Analysis of statically indeterminate structures
   - Plane trusses
   - Continuous structures
   - Mixed structures
2. Chapter 2 - Energy Theorems
   - Theorem of virtual works applied to continuous and trusses structures
   - Theorem of Clayperon
   - Theorem of Betti and Maxwell's reciprocal theorem
   - Theorem of Castigliano
   - Theorem of Menabrea
3. Chapter 3 - Calculation of displacements in isostatic structures using the theorem of virtual work
   - Calculation of displacement in isostatic truss structures
   - Calculation of displacement in isostatic continuous structures
4. Chapter 4 - Force Method
   - Calculation of hyperstatics trusses structures
   - Calculation of statically indeterminate structures
   - Calculation of displacements in statically indeterminate structures using theorem of virtual work
5. Chapter 5 - Influence lines
6. Chapter 6 - Actions and combination of actions

Recommended reading

1. Sebenta "Teoria das Estruturas" -Prof. Paulo Vila Real
2. Sebenta "Teoria das Estruturas" - FEUP
3. Sebenta "Exercicios resolvidos de Estruturas I" - Prof. Joaquim Barros e Salvador Dias, Universidade do Minho
4. "Structural analysis" - Alexander Chapes, Prentice Hall, International Edition
5. Apontamento de Estruturas I - Débora Macanjo Ferreira

Teaching and learning methods

Theoretical-practical classes: Presentation and discussion of all contents in theoretical classes along with simple ilustration problems. In theoretical-practical classes a set of application associated to theoretical issues is proposed and discussed. Four complementary individual exercises will be proposed and evaluated.

Assessment methods

1. Alternative 1 - (Regular, Student Worker) (Final)
   - Intermediate Written Test - 30%
   - Intermediate Written Test - 20%
   - Final Written Exam - 50%
2. Alternative 2 - (Regular, Student Worker) (Supplementary, Special)
   - Final Written Exam - 100%

Language of instruction

Portuguese, with additional English support for foreign students.

Electronic validation

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17-02-2023	17-02-2023	07-03-2023	10-03-2023