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| Course Unit | Structural Analysis II | Field of study | Mechanics of Materials and Structural Concrete | | |
| Bachelor in | Civil Engineering | School | School of Technology and Management | | |
| Academic Year | 2025/2026 | Year of study | 3 | Level | 1-3 |
| Type | Semestral | Semester | 1 | ECTS credits | 6.0 |
| Workload (hours) | 162 | Contact hours | T - | TP 60 | PL - |
| | | | TC - | S - | E - |
| | | | OT - | O - | |
| | | | Code 9089-849-3102-00-25 | | |

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 of the principles of behavior of reticulate structures and development of the displacement method to calculate it
2. Cross method

Prerequisites

Before the course unit the learner is expected to be able to:

1. Analysed the internal forces in isostatics structures
2. Determinate the internal forces diagrams

Course contents

Displacement method applied to: Hyperstatic truss structures and Hyperstatic continuous structures. Determinated mixed structures. Hardy Cross Method.

Course contents (extended version)

1. Chapter 1 - Analysis of structural hiperstaticity degree
 - Trusses structures
 - Continuous structures
2. Chapter 2 - Displacement Method
 - The displacement method as strength method's dual method
 - Direct formulation of the displacement method in the structures analysis.
 - Obtaining of an equation system
 - Determination of the final efforts.
 - Notion of stiffness matrix of a beam
 - Application of the displacement method in structures with beams with despicable axial deformability.
 - Use of the principle of virtual work to determine the fixation forces
 - Determination of the mobility degree of structures with beams despicable axial deformation
3. Chapter 3 - Hardy Cross Method
 - Introduction to the method
 - Notion of distribution and transmission coefficient
 - Particular case of Hardy Cross method
 - Application of Hardy Cross method to structures with freedom of displacement of nodes
 - Indirect Hardy Cross method

Recommended reading

1. Sebenta "Método dos deslocamentos", Prof. Joaquim António Oliveira de Barros - Universidade do Minho
2. Sebenta "Teoria das estruturas" - FEUP
3. Sebenta de Estruturas II "Método dos Deslocamentos" - IPB
4. Sebenta de Estruturas II "Método de Cross" - IPB

Teaching and learning methods

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

Assessment methods

1. Alternative 1 - (Regular, Student Worker) (Final)
 - Intermediate Written Test - 30%
 - Final Written Exam - 70%
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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| Debora Rodrigues de Sousa Macanjo Ferreira | António Miguel Verdelho Paula | José Carlos Rufino Amaro |
| 29-09-2025 | 09-10-2025 | 01-11-2025 |