# Numerical modelling of structural elements

**Academic Year: ( 2023 / 2024 )** **Review date: 15-12-2023**

**Department assigned to the subject: Continuum Mechanics and Structural Analysis Department**

**Coordinating teacher: GOMEZ SILVA, FRANCISCO**

**Type: Electives ECTS Credits : 3.0**

**Year : 4 Semester : 2**

## REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

-Mechanics of Structures
-Elasticity and Strength of Materials

## OBJECTIVES

By the end of this subject, students will be able to have:

1. a systematic understanding of the key aspects and concepts for the modeling structures with the finite element method.
2. the ability to apply their knowledge and understanding to identify, formulate and solve problems of structural mechanics using the finite element method;
3. the ability to select and apply the finite element method to structural mechanics problems.
4. an understanding of methodologies in finite element simulation to the design of structures and industrial constructions.
5. the ability to combine theory and practice of the finite element method to solve problems in the field of structural mechanics.
6. an understanding of applicable techniques and methods in finite element modeling, and of their limitations;

## DESCRIPTION OF CONTENTS: PROGRAMME

- Fundamental concepts. Rayleigh-Ritz method. Finite Element method.
- Application to structures: truss and beam finite elements.
- Application to two- and three-dimensional problems: triangle, quadrilateral and brick finite elements.
- Pre-processing and modeling techniques: selection of the element, meshing, symmetries, boundary conditions.
- Post-processing and analysis of results.

## LEARNING ACTIVITIES AND METHODOLOGY

-- 50% of theory lessons: learn the methodologies to solve mechanical problems with the Finite Element Method.
-- 50% of computer lessons: develop programming codes to solve mechanical problems with the Finite Element Method.

-- Tutorials and personal work of the student; oriented to the acquisition of practical skills related to the program of the subject.

## ASSESSMENT SYSTEM

1. CONTINUOUS ASSESSMENT:
A continuous assessment will be developed based on a number of practical group works, from which the students will have to hand in the developed codes. In order to pass the course, the attendance and performance of the laboratory practices foreseen in the weekly planning are compulsory. The weighting of the practice note in the continuous evaluation corresponds to the established in the course, in accordance with the university regulations. In the course Strength of Materials, the weighting of the laboratory practices takes the value of 50% of the final mark.

2. FINAL GRADE OF THE COURSE:
A final exam will be taken with a weight of 50% on the final grade.

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| **% end-of-term-examination:** | 50 |
| **% of continuous assessment (assigments, laboratory, practicals…):** | 50 |

BASIC BIBLIOGRAPHY

- P.M. Kurowski Finite Element Analysis For Design Engineers, SAE International, 2004
- T.R. Chandrupatla, A.D. Belegundu Introduction to Finite elements in Engineering, Prentice Hall, 1991

ADDITIONAL BIBLIOGRAPHY

- S. S. Quek, G.R. Liu The Finite Element Method: A Practical Course, Butterworth-Heinemann, 2003