Course guide
240636 - 240636 - Analysis of Structural and Mechanical Components by the Finite Element Methodology

Unit in charge: Barcelona School of Industrial Engineering
Teaching unit: 737 - RMEE - Department of Strength of Materials and Structural Engineering.
Degree: BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Optional subject).
Academic year: 2023  ECTS Credits: 4.5  Languages: Catalan

LECTURER
Coordinating lecturer: JORDI BONADA BO
Others:

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
2. Knowledge and capacities to apply fundamentals of materials’ elasticity and resistance to the behaviour of real solids.

Transversal:
1. TEAMWORK. Being able to work as a team player, either as a member or as a leader. Contributing to projects pragmatically and responsibly, by reaching commitments in accordance to the resources that are available.

TEACHING METHODOLOGY

Theory lessons: Mixed theory and problems sessions and self-assessment activities done outside the classroom.
Case studies: The knowledge will be acquired by the analysis of real models/problems.
Course team work: Self-learning and cooperative.

LEARNING OBJECTIVES OF THE SUBJECT

At the end of the course, students should be able to:

- Calculate the displacements, reactions and internal forces of structural beam components by the finite element method.
- Implement and develop a calculation algorithm to solve structural 2D beam problems.
- Develop models to analyse the behaviour of 3D structural or mechanical components using the finite element method.
- Reproduce different type of mechanical joints using the finite element method.
- Define contact elements.
- Analyse the results of a finite element simulation.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Self study</td>
<td>67,5</td>
<td>60.00</td>
</tr>
<tr>
<td>Hours medium group</td>
<td>45,0</td>
<td>40.00</td>
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</tbody>
</table>

Total learning time: 112.5 h
## Introduction to the finite element method

**Description:**
Definition of the finite elements used in a structural analysis, types of material behaviours and solution characteristics.

**Full-or-part-time:** 5h 30m  
Theory classes: 3h  
Self study: 2h 30m

## Structural beam elements

**Description:**

**Related activities:**  
Exercises done in classroom. Work 1.

**Full-or-part-time:** 43h 30m  
Theory classes: 13h 30m  
Self study: 30h

## Structural and mechanical 3D elements

**Description:**
Analysis of the displacement field and the stress state in 3D models. Implementation of the boundary conditions to reproduce joints. Introduction of the modal analysis through FEM. Introduction of the nonlinear analysis.

**Related activities:**
Case of study. Work 2.

**Full-or-part-time:** 54h  
Theory classes: 24h  
Self study: 30h

## Simulations with contact elements

**Description:**
Definition and implementation of contact analysis.

**Full-or-part-time:** 9h 30m  
Theory classes: 4h 30m  
Self study: 5h
GRADING SYSTEM

NF=0,3*NT1+0,3*NT2+0,4*NAC

NF: Final Mark
NT1: Mark of Work 1
NT2: Mark of Work 2
NAC: Mark of continuous assessment

EXAMINATION RULES.

NT1 and NT2: All teams have to do a report for each course work and prepare the oral presentation of one of the two works.
NAC: During the course the students have to deliver different problems.

BIBLIOGRAPHY

Complementary: