280672 - Numerical Calculus of Naval Structures

Coordinating unit: 280 - FNB - Barcelona School of Nautical Studies
Teaching unit: 742 - CEN - Department of Nautical Sciences and Engineering
Academic year: 2020
Degree: BACHELOR'S DEGREE IN MARINE TECHNOLOGIES/BACHELOR'S DEGREE IN NAVAL SYSTEMS AND TECHNOLOGY ENGINEERING (Syllabus 2016). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN NAVAL SYSTEMS AND TECHNOLOGY ENGINEERING (Syllabus 2010). (Teaching unit Compulsory)
ECTS credits: 4.5
Teaching languages: Spanish, English

Requirements
To take this course it is required to have approved the course 280669 - Estructures Aplicades a l'Enginyeria Naval

Degree competences to which the subject contributes

Transversal:
1. EFFECTIVE USE OF INFORMATION RESOURCES - Level 3. Planning and using the information necessary for an academic assignment (a final thesis, for example) based on a critical appraisal of the information resources used.

Teaching methodology
To acquire, understand and synthesize knowledge
Setting-up and resolution of problems
To carry works out individually and in group
To elaborate technical reports
To analyse results
To relate knowledge among different disciplines

Learning objectives of the subject
To offer the student a basic knowledge about the theory supporting the linear static analysis using the Finite Element Method (FEM).
To learn to use a professional software for analysis of naval structures using the FEM.
To give mainly practical criteria to analyse a naval structure, as well as to be able to evaluate the correctness of FEM results.

Study load

<table>
<thead>
<tr>
<th>Total learning time: 112h 30m</th>
<th>Hours large group:</th>
<th>15h</th>
<th>13.33%</th>
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<tbody>
<tr>
<td></td>
<td>Hours medium group:</td>
<td>0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Hours small group:</td>
<td>30h</td>
<td>26.67%</td>
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<td></td>
<td>Guided activities:</td>
<td>0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Self study:</td>
<td>67h 30m</td>
<td>60.00%</td>
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## Content

**Chapter 1. Introduction to matrix structural analysis**

**Learning time:** 3h  
**Theory classes:** 3h

**Description:**  

**Chapter 2. Introduction to the Finite Element Method (FEM)**

**Learning time:** 3h  
**Theory classes:** 3h

**Description:**  
Introduction to two dimensional and three dimensional elasticity.  
Stress and strain tensors. Stiffness matrix. Principal stresses.  
Application of the finite element method to 2D solids. Principle of the virtual work.  
Shape functions. Plain stress, plain strain and axilsymmetry.

**Chapter 3. Introduction to GiD-Ramseries**

**Degree competences to which the content contributes:**

**Description:**  
Introduction to the pre/postprocessor system GiD. Geometry creation.  
Introduction to the structural analysis environment Ramseries. Sections and materials. Boundary conditions.

**Chapter 4. Analysis of beam structures with the FEM**

**Degree competences to which the content contributes:**

**Description:**  
Analysis of beam structures with the Finite Element Method

**Chapter 5. Analysis of solid structures with the FEM**

**Degree competences to which the content contributes:**

**Chapter 6. Analysis of structures composed of plates, shells and beams with the FEM**

**Degree competences to which the content contributes:**
Chapter 7. Naval applications of the FEM

Degree competences to which the content contributes:

Qualification system

The final mark will be the weighted average of all the different evaluating activities in the subject:

\[ N_{final} = 0.20 \cdot N_{ex} + 0.40 \cdot N_{ec} + 0.40 \cdot N_{tc} \]

- \( N_{final} \): final mark
- \( N_{ex} \): mark of the partial exam
- \( N_{ec} \): mark of the different exercises and practices
- \( N_{tc} \): mark of the final project

The re-evaluation will consist of the solution of a practical assignment defined by the professors. This work will be focused on the aspects of the matter failed by the student. It will be required to deliver a written report on the work at the day of the exam. Furthermore, the student could be asked for an oral presentation on the work.

Regulations for carrying out activities

The student not presenting the proposed final project will be qualified as "not taken"

Bibliography