280817 - Lightweigth Structural Design

Coordinating unit: 280 - FNB - Barcelona School of Nautical Studies
Teaching unit: 751 - DECA - Department of Civil and Environmental Engineering
Academic year: 2020
Degree: MASTER’S DEGREE IN NAVAL AND OCEAN ENGINEERING (Syllabus 2017). (Teaching unit Optional)
ECTS credits: 5
Teaching languages: Spanish

Opening hours

Timetable: Before and after class

Prior skills

Advanced knowledge of strength of materials and structural analysis. Knowledge on numerical methods for structural analysis.

Degree competences to which the subject contributes

Specific:
CEE1-1. Conocimiento de las normativas existentes que regulan el proyecto de las embarcaciones de recreo y competición
CEE1-4. (ENG) Capacidad para analizar el comportamiento estructural y optimizar la estructura de embarcaciones de recreo y competición.
CEE1-7. Conocimiento de los materiales empleados en la construcción de embarcaciones de recreo. Conocimiento de sus condiciones de trabajo y requisitos de mantenimiento. Conocimiento del comportamiento mecánico de estos materiales y sus modos de fallo.

Transversal:
CT1. ENTREPRENEURSHIP AND INNOVATION: Knowing and understanding the organization of a company and the sciences that govern the activity; be able to understand the business rules and relationships between planning, industrial and commercial strategies, quality and profit.
Know and understand the mechanisms that scientific research is based, as well as the mechanisms and instruments of transfer of results between different socio-economic actors involved in the processes of R + D + i.
CT2. SUSTAINABILITY AND SOCIAL COMMITMENT: Know and understand the complexity of economic and social phenomena typical of the welfare society, being able to relate welfare to globalization and sustainability; acquire skills to use in a balanced manner compatible technology, technology, economics and sustainability.
CT3. TEAMWORK: Ability to work as a member of an interdisciplinary team, either as a member or performing management tasks, with the aim of contributing to projects pragmatically and sense of responsibility, assuming commitments considering the resources available.
CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Manage the acquisition, structuring, analysis and visualization of data and information in the field of specialty, and critically evaluate the results of this management.
CT5. THIRD LANGUAGE Learning a third language, preferably English, with adequate oral and written and in line with the future needs of the graduates.

Teaching methodology

Master Class
Class with students participation
Cooperative learning
Self learning by solving problems and exercises
Learning based on projects
280817 - Lightweigth Structural Design

**Learning objectives of the subject**

Capacity to design light structures made of composite materials.
Capacity to use this knowledge for the design of naval architecture structures.

**Study load**

<table>
<thead>
<tr>
<th>Total learning time: 45h</th>
<th>Hours large group: 45h</th>
<th>100.00%</th>
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</table>
## Content

<table>
<thead>
<tr>
<th><strong>Introduction to the analysis of light structures</strong></th>
<th><strong>Learning time:</strong> 5h</th>
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</thead>
</table>
| **Description:** Composite materials and components: fibers, matrices and core materials. Existing procedures for the analysis and design of composite materials structures. Use of composite structures in marine structures. | **Theory classes:** 3h  
**Self study:** 2h |

<table>
<thead>
<tr>
<th><strong>Laminate micromechanics</strong></th>
<th><strong>Learning time:</strong> 14h</th>
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</table>
| **Description:** Mechanical characteristics of composite laminae: elastic properties and failure criteria. Calculation of the laminae mechanical properties. Introduction to Cadec-online. | **Theory classes:** 3h  
**Practical classes:** 3h  
**Self study:** 8h |

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<thead>
<tr>
<th><strong>Composite structures design</strong></th>
<th><strong>Learning time:</strong> 45h</th>
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| **Description:** Rotation of the composite laminate. Laminate stiffness based on its typology: monolitic laminates, symmetric and unsymmetric laminates, sandwich structures, etc. Failure modes of composite laminate shells. Numerical analysis of composite structures. | **Theory classes:** 6h  
**Practical classes:** 9h  
**Self study:** 30h |

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<tr>
<th><strong>Advanced procedures for the analysis of composite structures</strong></th>
<th><strong>Learning time:</strong> 42h</th>
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</table>
| **Description:** Material non-linear analysis of structures. Damage and plasticity models. Classical mixing theory and serial/parallel mixing theory for the analysis of composite structures. Non-linear analysis of a composite structure. | **Theory classes:** 6h  
**Practical classes:** 6h  
**Self study:** 30h |
280817 - Lightweigth Structural Design

### Rules for the design of light structures

<table>
<thead>
<tr>
<th>Learning time: 19h</th>
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</thead>
<tbody>
<tr>
<td>Theory classes: 4h 30m</td>
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<tr>
<td>Practical classes: 4h 30m</td>
</tr>
<tr>
<td>Self study: 10h</td>
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### Description:
Specific rules defined by Classification Societies for the design of marine structures made of composite materials. Rules for the design of small crafts made with composite materials.

### Qualification system

The final mark of the course will be obtained with the following formula:

\[ N_{\text{final}} = 0.3 \cdot N_{\text{pp}} + 0.7 \cdot N_{\text{ec}} \]

*\(N_{\text{final}}\): Final Mark
*\(N_{\text{pp}}\): Mark obtained in a mid-term test
*\(N_{\text{ec}}\): Mark obtained from course projects and assignments

### Regulations for carrying out activities

The student must complete at least the 75% of the course exercises and assignments to be evaluated of the course. The student can have notes with equations, maximum 4 pages, in the course tests.
Bibliography

Basic:


Complementary:


Others resources: