# 280817 - Lightweigth Structural Design

<table>
<thead>
<tr>
<th>Coordinating unit:</th>
<th>280 - FNB - Barcelona School of Nautical Studies</th>
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<tbody>
<tr>
<td>Teaching unit:</td>
<td>751 - DECA - Department of Civil and Environmental Engineering</td>
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<tr>
<td>Academic year:</td>
<td>2019</td>
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<tr>
<td>Degree:</td>
<td>MASTER'S DEGREE IN NAVAL AND OCEAN ENGINEERING (Syllabus 2017). (Teaching unit Optional)</td>
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<tr>
<td>ECTS credits:</td>
<td>5</td>
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<td>Teaching languages:</td>
<td>Spanish</td>
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## Teaching staff

**Coordinator:** SERGIO HORACIO OLLER MARTINEZ

## 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.
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Teaching methodology

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

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

## Introduction to the analysis of light structures

**Learning time:** 5h  
Theory classes: 3h  
Self study: 2h

**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.

## Laminate micromechanics

**Learning time:** 14h  
Theory classes: 3h  
Practical classes: 3h  
Self study: 8h

**Description:**  
Mechanical characteristics of composite laminae: elastic properties and failure criteria. Calculation of the laminae mechanical properties. Introduction to Cadec-online.

## Composite structures design

**Learning time:** 45h  
Theory classes: 6h  
Practical classes: 9h  
Self study: 30h

**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.

## Advanced procedures for the analysis of composite structures

**Learning time:** 42h  
Theory classes: 6h  
Practical classes: 6h  
Self study: 30h

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

$$N_{final} = 0.3 \times N_{pp} + 0.7 \times N_{ec}$$

- **Nfinal**: Final Mark
- **Npp**: Mark obtained in a mid-term test
- **Nec**: Mark obtained from course projects and assignments

**Qualification system**

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.

**Rules for the design of light structures**

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.

**Learning time:** 19h
- Theory classes: 4h 30m
- Practical classes: 4h 30m
- Self study: 10h

**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.

**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.
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Bibliography

Basic:


Complementary:


Others resources: