280806 - Analysis and Design of Ship and Ocean Structures

Coordinating unit: 280 - FNB - Barcelona School of Nautical Studies
Teaching unit: 742 - CEN - Department of Nautical Sciences and Engineering
Academic year: 2020
Degree: MASTER’S DEGREE IN NAVAL AND OCEAN ENGINEERING (Syllabus 2017). (Teaching unit Compulsory)
ECTS credits: 5  Teaching languages: Spanish

Opening hours
Timetable: Tuesday, Wednesday, Thursday

Prior skills
Bachelor in Naval Architecture

Degree competences to which the subject contributes

Basic:
CB6. Possess knowledge and understanding that provide a basis or opportunity to be original in the development and / or application of ideas, often in a research context.
CB7. That the students can apply their knowledge and ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their study area.
CB8. Students should be able to integrate knowledge and handle the complexity of making judgments based on information that, being incomplete or limited, includes reflections on the responsibilities social and ethical linked to the application of their knowledge and judgments.

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CB9. That students can communicate their conclusions and the knowledge and latest rationale underpinning to specialists and non-specialty clearly and unambiguously
CB10. Students must possess the learning skills that enable them continue studying in a way that will be largely
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self-directed or autonomous.

Specific:
CE1. (ENG) Capacidad para proyectar buques adecuados a las necesidades del transporte marítimo de personas y mercancías, y a las de la defensa y seguridad marítimas.
CE3. Conocimiento de la dinámica del buque y de las estructuras navales, y capacidad para realizar análisis de optimización de la estructura, de la integración de los sistemas a bordo, y del comportamiento del buque en la mar y de su maniobrabilidad.
CE6. (ENG) Capacidad para definir la estrategia constructiva de los buques y para planificar y controlar su desarrollo.
CE7. (ENG) Capacidad para proyectar plataformas y artefactos oceánicos.

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

Learning objectives of the subject
- Capacity to design and develop the project of a ship or a marine structure, according to given requirements.
- Capacity to solve correctly problems related to marine and ship engineering based on serviceability needs as well as fulfilling safety, environmental and economic requirements.
- Capacity to apply basic and advanced concepts regarding marine and ship engineering to the solution of problems of marine and ship engineering.
- Knowledge of the structural strength mechanisms and their application for designing ships and offshore platforms.
- Knowledge of the most common failure mechanisms and the means to prevent them. Capacity to design safe structures complying with standards.
- Capacity to solve complex mathematical problems and their application to the solution of engineering problems.
- Knowledge of the numerical tools available to solve these problems.
<table>
<thead>
<tr>
<th>Study load</th>
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<tr>
<td><strong>Total learning time:</strong> 45h</td>
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## Content

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<tr>
<th>Topic</th>
<th>Learning time</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>Introduction to ship design and marine structures</strong></td>
<td><strong>6h</strong></td>
<td>Design procedure of the ship and marine structures. Limit state analysis. Relation between limit state analysis and strength of materials theory. Numerical analysis methods.</td>
</tr>
<tr>
<td><strong>Structural elements analysis and design</strong></td>
<td><strong>35h 30m</strong></td>
<td>Normal and tangential stresses in beam elements. Lateral buckling of beams. Buckling of panels. Analysis of bolted connections. Analysis of welded connections.</td>
</tr>
<tr>
<td><strong>Loads in ships and marine structures</strong></td>
<td><strong>16h</strong></td>
<td>Loads in ships. Loads in marine structures. Load combination.</td>
</tr>
<tr>
<td><strong>Longitudinal strength of hull girder</strong></td>
<td><strong>21h</strong></td>
<td>Longitudinal strength of hull girder. Ship cross sections. Longitudinal stresses in the ship. Torsional effects on the hull. Elements distribution and stress concentrations.</td>
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### Transverse strength of the ship

**Learning time:** 12h 30m  
- Theory classes: 2h  
- Practical classes: 2h 30m  
- Self study: 8h

**Description:**  
Transverse strength of the ship. Design and analysis of structural elements.

### Analysis structural elements in the ship

**Learning time:** 16h  
- Theory classes: 1h 30m  
- Guided activities: 4h 30m  
- Self study: 10h

**Description:**  
Design of structural elements in the ship. Structural particularities of the different structural elements of the ship.

### Dynamic analysis of marine structures

**Learning time:** 18h  
- Theory classes: 3h  
- Practical classes: 3h  
- Self study: 12h

**Description:**  
Theoretical background behind the modal analysis of structures. Modal analysis of structures. Hull structure vibrations.

### 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 five pages, in the course tests.
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Bibliography

Basic:


Others resources: