280800 - Ship Dynamics

Coordinating unit: 280 - FNB - Barcelona School of Nautical Studies
Teaching unit: 742 - CEN - Department of Nautical Sciences and Engineering
Academic year: 2019
Degree: MASTER'S DEGREE IN NAVAL AND OCEAN ENGINEERING (Syllabus 2017). (Teaching unit Compulsory)
ECTS credits: 5
Teaching languages: Catalan, English

Teaching staff

Coordinator: ANNA MUJAL COLILLES
Others: Primer quadrimestre:
        ANNA MUJAL COLILLES - 1

Degree competences to which the subject contributes

Specific:
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.

Transversal:
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

MD1. Lectures
MD2. Participative lecturers
MD4. Self-study by solving exercises
MD5. Learning based in problems / projects

Learning objectives of the subject

Acquire a basic knowledge of ship dynamics and how to predict ship motions in advance. Provide information on fundamentals of linear and non-linear ship motion in calm water and in waves. Establish a background of applied methods for description of natural ocean waves and calculation of forces and moments on ship due to sea loads and the resultant ship motion.
### Study load

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

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# Content

## Chapter 1. Mathematical concepts

**Description:**
Basic sea statistics and probabilistic concepts. Significant wave height, wave period and wavelength. Probabilistic projection of the sea waves. Fourier Transform tools to represent a wave height signal.

**Learning time:** 16h
- Theory classes: 6h
- Self study: 10h

## Chapter 2. Ship dynamics. Sea representation and characteristics

**Description:**

**Learning time:** 24h
- Theory classes: 9h
- Self study: 15h

## Chapter 3. Ship Dynamics. Vessel Motions

**Description:**

**Learning time:** 24h
- Theory classes: 9h
- Self study: 15h

## Chapter 4. Stabilizer systems

**Description:**
Description of the classification and functionality of the different stabilizer systems. Bilge keels, active roll stabilisers, stabiliser tanks, among others.

**Learning time:** 8h
- Theory classes: 3h
- Self study: 5h
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<table>
<thead>
<tr>
<th>Chapter 5. Seakeeping</th>
<th>Learning time: 8h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 3h</td>
</tr>
<tr>
<td></td>
<td>Self study: 5h</td>
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**Description:**
Effects in seakeeping: slamming, deck wetness, propeller emergence. Introduces the necessary skills for carry out practices using the simulation program "Maxsurf Motions" successfully.

<table>
<thead>
<tr>
<th>Chapter 6. Ship model experiments</th>
<th>Learning time: 16h</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 6h</td>
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<tr>
<td></td>
<td>Self study: 10h</td>
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</table>

**Description:**
Describe the different types of model experiments used to predict ship maneuvering behaviour and explain their limitations.

<table>
<thead>
<tr>
<th>Chapter 7. Manoeuvring characteristics and port manoeuvres</th>
<th>Learning time: 16h</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 6h</td>
</tr>
<tr>
<td></td>
<td>Self study: 10h</td>
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</tbody>
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**Description:**
Controllability and maneuverability concepts. Explain the principles and conduct of manoeuvring trials. Effect of restricted water on the manoeuvring characteristics of a vessel.

<table>
<thead>
<tr>
<th>Chapter 8. Rudder and propeller effect</th>
<th>Learning time: 8h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 3h</td>
</tr>
<tr>
<td></td>
<td>Self study: 5h</td>
</tr>
</tbody>
</table>

**Description:**
Explain the effect of rudder and propeller on manoeuvring of a ship both at low speed and at normal cruising speed. Rudder loads. Rudder design.
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**Qualification system**

The final score is the sum of the following partial grades:

\[ N_{\text{final}} = 0.4N_{\text{fp}} + 0.3N_{\text{sp}} + 0.3N_{\text{ac}} \]

The second exam will be evaluated only if the marks of the first exam are larger or equal to 3.5. Otherwise, the class will be evaluated as follows:

\[ N_{\text{final}} = 0.7N_{\text{ef}} + 0.3N_{\text{ac}} \]

Also, students have the free evaluation option which consists of the marks of the final exam.

Nac will only be evaluated if all the works are presented on time.

- \( N_{\text{final}} \): final score
- \( N_{\text{fp}} \): first partial exam
- \( N_{\text{sp}} \): second partial exam
- \( N_{\text{ac}} \): continuous assessment
- \( N_{\text{ef}} \): final exam marks

Partial exams consist of some issues associated with the learning objectives of the course so that respects the knowledge and understanding concepts, and a set of application exercises. The continuous assessment consists of different activities cumulative and formative character, both individual and group, made during the course.

**Regulations for carrying out activities**

You can't pass the course if all work activities and continuous assessment are carried out and submitted. If the student does not carry out partial and/or final exam, he or she will be considered as: Not Presented. In any case, the student can use any kind of predesigned form in controls or tests.

**Bibliography**

**Basic:**

