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, Spanish, English

Teaching staff
Coordinator: ANNA MUJAL COLILLES
Others: Primer quadrimestre:
ARANTXA LLAMBRICH PONCE - 1
ANNA MUJAL COLILLES - 1

Opening hours
Timetable: Marcel·la Castells. Thursday 12-14 / Friday 12-14
Anna Mujal-Colilles. Monday 15-17

Degree competences to which the subject contributes
Specific:
CE3. (ENG) 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>

## Content

### Chapter 1. Mathematical concepts

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

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

<table>
<thead>
<tr>
<th>Learning time:</th>
<th>24h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes:</td>
<td>9h</td>
</tr>
<tr>
<td>Self study :</td>
<td>15h</td>
</tr>
</tbody>
</table>

**Description:**

### Chapter 3. Ship Dynamics. Vessel Motions

<table>
<thead>
<tr>
<th>Learning time:</th>
<th>24h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes:</td>
<td>9h</td>
</tr>
<tr>
<td>Self study :</td>
<td>15h</td>
</tr>
</tbody>
</table>

**Description:**

### Chapter 4. Stabilizer systems

<table>
<thead>
<tr>
<th>Learning time:</th>
<th>8h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes:</td>
<td>3h</td>
</tr>
<tr>
<td>Self study :</td>
<td>5h</td>
</tr>
</tbody>
</table>

**Description:**
Description of the classification and functionality of the different stabilizer systems. Bilge keels, active roll stabilisers, stabiliser tanks, among others.
### Chapter 5. Seakeeping

**Learning time:** 8h  
- Theory classes: 3h  
- Self study: 5h

**Description:**  
Effects in seakeeping: slaming, deck wetness, propeller emergence. Introduces the necessary skills for carry out practices using the simulation program "Maxsurf Motions" successfully.

### Chapter 6. Ship model experiments

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

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

### Chapter 7. Manoeuvring characteristics and port manoeuvres

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

**Description:**  
Controllability and maneuverability concepts. Explain the principles and conduct of manoeuvring trials. Effect of restricted water on the manoeuvring characteristics of a vessel.

### Chapter 8. Rudder and propeller effect

**Learning time:** 8h  
- Theory classes: 3h  
- Self study: 5h

**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.
Qualification system

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

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

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

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:

