280716 - 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 NAUTICAL SCIENCE AND MARITIME TRANSPORT MANAGEMENT (Syllabus 2016). (Teaching unit Compulsory)
ECTS credits: 5  Teaching languages: English

Teaching staff
Coordinator: MARCEL·LA CASTELLS SANABRA
Others: MARCEL·LA CASTELLS SANABRA

Opening hours
Timetable: Monday 11-13
          Wednesday 11-13

Degree competences to which the subject contributes

Specific:
CE11. Apply and calculate the dynamic responses of the ship in different load conditions and in different scenarios affected agents external.

General:
CG2. Apply general knowledge of the structure and behavior in the Sea ship.

Transversal:
CT5. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

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.

On the other hand, one of the objectives of this subject is provide the knowledge, understanding and proficiency of the competency "Assess reported defects and damage to cargo spaces, hatch covers and ballast tanks and take appropriate action" competency required and defined in Section A-II/2-13 (Mandatory minimum requirements for certification of
masters and chief mates on ships of 500 gross tonnage or more) of the Seafarers Training, Certification and Watchkeeping (STCW) International Code.

### Study load

| Total learning time: 45h | Hours large group: | 45h | 100.00% |
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### Content

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Description</th>
<th>Learning time</th>
<th>Theory classes</th>
<th>Self study</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chapter 1. Hull Strength</strong></td>
<td>In this chapter longitudinal hull strength covers the relationship between the longitudinal distribution of the ship's buoyancy and the ability of the ship to cope with the internal and external stresses applied on it. The student will be aware of the limits of his vessel's allowable hull stress in port as well as at sea just as he knows what his ship's minimum required GM and conditions of trim are. Knowledge of the limitations on strength of the vital constructional parts of a standard bulk carrier and ability to interpret given figures for bending moments and shear forces. Ability to explain how to avoid the detrimental effects on bulk carriers of corrosion, fatigue and inadequate cargo handling competency (this knowledge is necessary in accordance with STCW Code Table A-II/2-13.1 and 13.2)</td>
<td>41h 40m</td>
<td>3h</td>
<td>38h 40m</td>
</tr>
<tr>
<td><strong>Chapter 2. Representation of sea waves and seakeeping</strong></td>
<td>This chapter describes the fundamental notions of representation of sea waves for further study of seakeeping of a vessel and introduces the necessary skills for carry out practices using the simulation program &quot;Maxsurf Motions&quot; successfully.</td>
<td>16h 40m</td>
<td>3h</td>
<td>13h 40m</td>
</tr>
<tr>
<td><strong>Chapter 3. Waves and synchronism</strong></td>
<td>This chapter presents the basic characteristics of the waves and their influence on the course and speed of the ship. Rolling and pitching synchronism is described. Basic knowledge about the classification and behavior of waves in front of some obstacles (refraction, reflection and diffraction) is also given.</td>
<td>41h 40m</td>
<td>6h</td>
<td>35h 40m</td>
</tr>
<tr>
<td><strong>Chapter 4. Weather navigation</strong></td>
<td>The main objective of this chapter is that students know the resources associated with ship weather information useful for defining the optimum track for voyages based on weather, sea conditions and ship's characteristics.</td>
<td>8h 20m</td>
<td></td>
<td>8h 20m</td>
</tr>
</tbody>
</table>
### Chapter 5. Ship maneuverability guidelines

**Description:**
This chapter treats about the maneuverability guidelines of a ship with the objective of having minimums acceptable, including the ability to move laterally (evolution and change of course) as well as the need to move laterally whenever it is not necessary (course stability). The requirements are studied according to the IMO regulation MSC 137 (76). Also this chapter describes the behavior and the operational limits of ships sailing at high speed.

**Learning time:** 8h 20m  
Self study : 8h 20m

### Chapter 6. Rudder project and design guidelines

**Description:**
Explain the effect of rudder on manoeuvring of a ship. Rudder loads and Rudder design.

**Learning time:** 8h 20m  
Self study : 8h 20m

### Qualification system

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

\[ N_{\text{final}} = 0.2N_{\text{pf}} + 0.3N_{\text{pp}} + 0.5N_{\text{ec}} \]

- **Npf:** final score  
- **Npp:** partial exam  
- **Nec:** score of the continuous assessment

Examination and assessment of chapter 1 will be using: stability, trim and stress tables, diagrams and stress-calculating equipment (A-II/2-13).

Evaluations are based on accepted principles, well-founded arguments and correctly carried out. The decisions taken are acceptable, taking into consideration the safety of the ship and the prevailing conditions. (A-II/2-13)

### Regulations for carrying out activities

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

Basic:


Complementary:
