Degree competences to which the subject contributes

Specific:
1. Knowledge of methods of design of naval propulsion systems.

Teaching methodology

Lectures and resolution of problems. Exercises proposed by the teacher. Individual and team works. Tutorials.

Learning objectives of the subject

Learn the procedures to select a marine propeller. Understand the different propulsive systems nowadays and their needs. Then student must be able to apply the knowledge learned to assemble and maintenance of marine propellers and their propulsive system. Discern the different propulsive solutions. Make basic calculus of propeller design. Understand the cavitation phenomenon, problems involved and solutions to make. The student should be able to choose a main engine according to the needs and requirements of the vessel.

Study load

<table>
<thead>
<tr>
<th>Study load</th>
<th>Hours large group:</th>
<th>45h</th>
<th>24.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total learning time: 187h 30m</td>
<td>Hours medium group:</td>
<td>23h 18m</td>
<td>12.43%</td>
</tr>
<tr>
<td></td>
<td>Hours small group:</td>
<td>0h</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>Guided activities:</td>
<td>6h 42m</td>
<td>3.57%</td>
</tr>
<tr>
<td></td>
<td>Self study:</td>
<td>112h 30m</td>
<td>60.00%</td>
</tr>
</tbody>
</table>
## Content

| Lesson 1: Introduction to hydrodynamics. Components of the drag resistance | Learning time: 15h  
Theory classes: 15h |
|---|---|
| **Description:**  
Components of the drag resistance. Froude's theory.  
Viscous drag resistance: flat plane, frictional lines, form factor, viscous pressure drag, boundary layer separation, form influences, rugosity.  
Wave making drag resistance: wave system related to the ship, limited depth, lateral restriction, wave pattern.  
Other components: appendages drag resistance, aerodynamic drag resistance. |

| Lesson 2: Tests with models. Vessel design | Learning time: 15h  
Theory classes: 15h |
|---|---|
| **Description:**  
Tests with models: towing tanks, scale effects, correlation methods.  
Vessel design: systematic series, influences of the shape, non-conventional vessels.  
Methods used nowadays to design ships. |

| Lesson 3: Introduction to propellers. Fundamentals of propellers. | Learning time: 15h  
Theory classes: 15h |
|---|---|
| **Description:**  
Introduction: Elements of the propulsion machinery. Geometry of the propeller.  
Fundamentals: Momentum theory, circulation theory, blade element theory. |

| Lesson 4: Tests with propellers. Study of the cavitation. | Learning time: 15h  
Theory classes: 15h |
|---|---|
| **Description:**  
Open-water tests: fulfilment of test, purpose of the test.  
Autopropulsive test: Fulfilment of the test, purpose of the test, propeller-hull interaction, study of the wake.  
Cavitation: Phenomenon, reasons and ways to appear, effects to the propeller, prevention. |
Lesson 5: Propeller projects. Choosing the main engine

<table>
<thead>
<tr>
<th>Description:</th>
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</thead>
<tbody>
<tr>
<td>Systematic series, optimal diameter, optimum speed. Different types of propellers: controllable pitch propellers, waterjet, vertical axis, cavitation propellers, pods.</td>
</tr>
</tbody>
</table>

Learning time: 15h
Theory classes: 15h

Qualification system

CONTINUOUS EVALUATION

Ncourse = 0.40*P1 + 0.40*P2 + 0.20*Nt

Nt: marks of assignments done in groups and individually.
P1: first test. Hydrodynamics and drag resistance lectures will be evaluated.
P2: second test. Propeller lectures will be evaluated. This test will be done the last day of the course.
Final test: Those students that want improve their marks in any part of the P1 and P2 can do the final exam. The mark in those parts evaluated in the final exam, will be the final mark for each part.

REEVALUATION:
The reevaluation will be a written exam that comprises all the concepts seen during the course.

Regulations for carrying out activities

The tests during the course are divided into theoretical concepts and exercises. Each part of the test must have a minimum mark of 4.0.
The student with a part below the 4.0 has to do again that part in the final exam of January.
If a part of the final exam has been done, the marks corresponding with each mark are used to calculate the final qualification.
The final exam of January makes average with the marks of the assignments. In the reevaluation exam, the assignment mark does not count for the final qualification.

Bibliography

Basic:

