280671 - Materials in the Naval Industry

Degree competences to which the subject contributes

- Know the different construction materials used in the shipbuilding industry and its characteristics. Emphasis will be placed on the maintenance and prevention of corrosive processes.
- Apply the knowledge acquired on the assembly and maintenance of marine propellants.
- Apply the criteria for optimum selection of materials in the different sections of the ship or naval system, considering structural aspects, performance, recyclability and durability. Concepts of product life cycle and circular economy will be exposed.

Teaching unit: 742 - CEN - Department of Nautical Sciences and Engineering
Academic year: 2020
ECTS credits: 7,5
Teaching languages: Catalan, Spanish, English

Opening hours

Timetable: Monday 5:00 p.m. - 7:00 p.m.
            Friday 1:00 p.m - 3:00 p.m

Prior skills

Knowledge and skills in: science and materials engineering, chemistry, physics, thermodynamics and thermotechnics
Skills acquired in design and structural analysis of marine systems

Requirements

Physics
Chemistry
Mechanics, Resistance and Technology of materials
Projects on Naval Technology and Systems

Degree competences to which the subject contributes

Specific:

1. Knowledge of science and technology of materials and capacity for selection and evaluation of their behavior
2. Knowledge of materials for machinery, equipment and naval systems and criteria for selection.

Teaching methodology

Receive, understand and synthesize knowledge.
Raise and solve problems.
Develop the reasoning and critical spirit and defend it in an oral or written way.
Do a group job.
Properly select materials oriented to the production of products within the naval field applying methodologies of optimal selection of materials

Learning objectives of the subject

- Know the different construction materials used in the shipbuilding industry and its characteristics. Emphasis will be placed on the maintenance and prevention of corrosive processes.
- Apply the knowledge acquired on the assembly and maintenance of marine propellants.
- Apply the criteria for optimum selection of materials in the different sections of the ship or naval system, considering structural aspects, performance, recyclability and durability. Concepts of product life cycle and circular economy will be exposed.
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- Study with books and articles in English.

### Study load

<table>
<thead>
<tr>
<th>Total learning time: 187h 30m</th>
<th>Hours large group: 45h</th>
<th>24.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours medium group: 23h 18m</td>
<td>12.43%</td>
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<tr>
<td>Hours small group: 0h</td>
<td>0.00%</td>
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<tr>
<td>Guided activities: 6h 42m</td>
<td>3.57%</td>
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<tr>
<td>Self study: 112h 30m</td>
<td>60.00%</td>
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<table>
<thead>
<tr>
<th><strong>Content</strong></th>
<th><strong>Learning time:</strong></th>
<th><strong>Description:</strong></th>
<th><strong>Related activities:</strong></th>
<th><strong>Specific objectives:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(ENG) Iron alloys and stainless steels</strong></td>
<td>15h</td>
<td>Manufacture of steel. Thermal treatments. Steel boat sections. Shipbuilding steel. High tension steel. Corrosion resistant steel. Sandwiche or steel panels. Mechanical treatments.</td>
<td>To solve problems of materials and their application to the behaviour of real solids in structures, marine facilities and equipment. To Use of material selection techniques, analytical processes and guided by material selection software Group work to select materials according to their application in specific sections of the ship and other naval or marine systems</td>
<td>To determine the behaviour of different ferrous alloys when subjected to Tension and to obtain the following Tensile properties of materials on Universal Testing Machine. To determine the corrosion resistance of the ferrous alloys, the methods to improve their behaviour in marine environments To select optimal alloys following the classification societies rules</td>
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<tr>
<td><strong>(ENG) Aleaciones de Aluminio.</strong></td>
<td>10h</td>
<td>Production of Aluminum. Sandwich or aluminium panels. Protection against fire.</td>
<td>To solve problems of materials and their application to the behaviour of real solids in structures, marine facilities and equipment. To Use of material selection techniques, analytical processes and guided by material selection software Group work to select materials according to their application in specific sections of the ship and other naval or marine systems</td>
<td>To define the behaviour of different aluminium alloys when they are subjected to tension and obtain the following tensile properties of the materials of the universal test machine. To define the corrosion resistance of aluminium alloys and methods to improve their performance in marine environments To Select optimal aluminium alloys following the rules of the classification societies in different parts of the ship, hull, covers, parts of machines, etc.</td>
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</tbody>
</table>
### (ENG) Sociedades de Clasificación.

**Description:**

**Related activities:**
- Analysis of class certifications
- Analysis of statutory certifications
- Analysis of checklists prior to a class or port state inspection
- Study of tests on naval materials

**Specific objectives:**
- To apply the different regulations defined by the classification societies, the IACS and the IMO related to the design and selection of materials used in the marine sector and marine systems
- To understand the functioning of the different organisms and maritime safety schemes in the construction of vessels, their inspection and registration, classification and maintenance of the class, port state control and memoranda of understanding
- To understand the principles governing ship inspections and their management through the EQUASIS databases and other sub-standard vessel listing systems

### (ENG) Resistencia de Materiales.

**Description:**

**Related activities:**
- Resolution of problems about mechanical properties of materials
- Analysis of different deformation stress curves
- Identification of the different limits of materials subjected to stress

**Specific objectives:**
- To determine the behaviour of different materials when subjected to Tension and to obtain the following Tensile properties of materials on Universal Testing Machine:
  - (i) UTS,
  - (ii) Yield Stress,
  - (iii) Young’s Modulus,
  - (iv) Breaking Stress,
  - (v) Percentage Elongation,
  - (vi) Percentage reduction in area
- and (vi) Plotting of Curve of Stress vs Strain.
Composite materials and other types of materials

<table>
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<tr>
<th>Learning time: 15h</th>
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<tbody>
<tr>
<td>Theory classes: 10h</td>
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<tr>
<td>Guided activities: 5h</td>
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Description:
Properties and uses of these materials in specific applications within the naval systems

Related activities:
- Exercises and problems applied
- Selection in CES edupack software
- Selection of materials for the work of the subject

Specific objectives:
- Have a wide range of materials in order to choose the best materials that allow them to design and manufacture useful products in different sections of the ship, naval system or propulsion
- Apply optimal selection techniques through selection matrices, classification societies standards and specific selection software. The use of CES Edupack software is recommended

Qualification system

\[ N_{final} = 0.5 \cdot N_{pf} + 0.5 \cdot N_{ac} \]

- Nfinal: final and global grade
- Npf: final exam grade
- Nac: continuous evaluation grade

The final test consists of a written exam where all the concepts and elements dealt with in the subject will be evaluated, both on a practical and theoretical level.
The continuous assessment note consists of 30% of the grade of a group work. It is a necessary condition to pass the course to submit and have approved with a minimum grade of 6.0 the work. The remaining 20% of the grade corresponds to a partial exam.

Regulations for carrying out activities

Students must submit the work of the subject and obtain a minimum grade of 6.0. In case of not exceeding this minimum grade, the subject is considered suspended.
All the works and tests of continuous evaluation delivered after the deadline or form will be considered as NOT delivered and will not be qualified.
In the final exam you can only have a calculator, pen and the notes and/or material authorized by the teacher.
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Bibliography

Basic:


Complementary:


Others resources:

CES EduPack 2019
CES EduPack is the world-leading teaching resource for materials in engineering, science, processing, and design.