280655 - Internal Combustion Engines

Coordinating unit: 280 - FNB - Barcelona School of Nautical Studies
Teaching unit: 742 - CEN - Department of Nautical Sciences and Engineering
Academic year: 2019
Degree: BACHELOR’S DEGREE IN MARINE TECHNOLOGIES/BACHELOR’S DEGREE IN NAVAL SYSTEMS AND TECHNOLOGY ENGINEERING (Syllabus 2016). (Teaching unit Compulsory)
BACHELOR’S DEGREE IN MARINE TECHNOLOGIES (Syllabus 2010). (Teaching unit Compulsory)
ECTS credits: 9
Teaching languages: Spanish

Degree competences to which the subject contributes

Specific:
2. Knowledge of the fundamentals of Fluid Mechanics machines and systems, internal combustion engines, steam turbines and gas, steam generators, cooling and air conditioning.
3. Ability to design and manage energy optimization systems applied to marine installations.

Transversal:
1. SUSTAINABILITY AND SOCIAL COMMITMENT - Level 2. Applying sustainability criteria and professional codes of conduct in the design and assessment of technological solutions.

Teaching methodology

Acquire, understand and synthesize knowledge.
And solve problems.
Prepare technical reports.
Adopt solutions in practical cases.

Learning objectives of the subject

Understanding of the theoretical and practical operation of internal combustion engines.
Knowledge of the various types and their facilities on board.
Knowledge of the calculation of powers, jobs, performances, consumption, etc.
Know the concept of life cycle of a product and apply it to the development of products and services in the field of marine engineering, using the appropriate legislation and legislation.

On the other hand, one of the objectives of this subject is to give knowledge, understanding and aptitude of the competences of Annex III/1 of the STCW:

4. Operate the main and auxiliary machine and the corresponding control systems.
4.1 Basic principles of construction and operation of machinery systems, including:
   .1 marine diesel engine
   .9 fluid flow and characteristics of lubricating oil, fuel oil and cooling systems
4.2 Safety and emergency procedures for the operation of propulsion plant machinery, including control systems
4.3 Preparation, operation, fault detection and necessary measures to avoid damage to the elements of the machinery and systems of control:
   .1 main engine and associated auxiliaries
   .3 auxiliary primary engines and associated systems

9. Maintenance and repair of equipment and equipment on board
   9.1 Safety measures to be taken for repair and maintenance, including the safe isolation of machinery and equipment from a
   the team requires equipment before the staff is ready to work on such equipment or equipment
   9.2 Basic knowledge and basic skills
   9.3 Maintenance and repair, such as disassembly, adjustment and assembly of equipment and equipment
   9.4 The use of special tools and measuring instruments
   9.5 Characteristics of design and selection of materials in the construction of equipment
   9.6 Interpretation of drawings of machinery and manuals
   9.7 The interpretation of pipelines, hydraulic and pneumatic diagrams

This knowledge is necessary in accordance with STCW Code A-III/1 and it’s developed according to OFFICER IN CHARGE OF AN ENGINEERING WATCH (Model course 7.04) (2014 Edition)

### Study load

<table>
<thead>
<tr>
<th>Total learning time: 225h</th>
<th>Hours large group: 50h</th>
<th>22.22%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group: 20h</td>
<td>8.89%</td>
</tr>
<tr>
<td></td>
<td>Hours small group: 10h</td>
<td>4.44%</td>
</tr>
<tr>
<td></td>
<td>Guided activities: 10h</td>
<td>4.44%</td>
</tr>
<tr>
<td></td>
<td>Self study: 135h</td>
<td>60.00%</td>
</tr>
<tr>
<td>Content</td>
<td>Learning time: 6h</td>
<td></td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>-------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Application and classification of internal combustion engines (MCI).</strong></td>
<td>Theory classes: 6h</td>
<td></td>
</tr>
<tr>
<td><strong>Description:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Study on the different applications of internal combustion engines and ranking.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fundamental concepts and general definitions of MCI.</strong></td>
<td>Theory classes: 6h</td>
<td></td>
</tr>
<tr>
<td><strong>Description:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schematic and nomenclature of the reciprocating engine. The engine ignition. The compression ignition engine. Differences between MECh and MEC. Working fluid.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Thermal cycles.</strong></td>
<td>Theory classes: 6h</td>
<td></td>
</tr>
<tr>
<td><strong>Description:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Engine operating cycles two and four times.</strong></td>
<td>Theory classes: 6h</td>
<td></td>
</tr>
<tr>
<td><strong>Description:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indicated cycle and mean pressure indicated. Differences between actual and theoretical cycles. Study diagram indicated. Pressure diagram.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Organizational study of the engine.

**Description:**

**Specific objectives:**
4. Operate the main and auxiliary machine and the corresponding control systems.
4.1 Basic principles of construction and operation of machinery systems, including:
   .1 marine diesel engine
   .9 fluid flow and characteristics of lubricating oil, fuel oil and cooling systems
4.2 Safety and emergency procedures for the operation of propulsion plant machinery, including control systems
4.3 Preparation, operation, fault detection and necessary measures to avoid damage to the elements of the machinery and systems of control:
   .1 main engine and associated auxiliaries
   .3 auxiliary primary engines and associated systems

Calculation of powers, yields and consumptions.

**Description:**
Indicated power. Effective power. Power absorbed by passive resistance. Mean effective pressure. Yields.

Engine performance and factors that influence it.

**Description:**

**Specific objectives:**
9. Maintenance and repair of equipment and equipment on board
   9.1 Safety measures to be taken for repair and maintenance, including the safe isolation of machinery and equipment from a
      the team requires equipment before the staff is ready to work on such equipment or equipment
   9.2 Basic knowledge and basic skills
   9.3 Maintenance and repair, such as disassembly, adjustment and assembly of equipment and equipment
   9.4 The use of special tools and measuring instruments
   9.5 Characteristics of design and selection of materials in the construction of equipment
   9.6 Interpretation of drawings of machinery and manuals
   9.7 The interpretation of pipelines, hydraulic and pneumatic diagrams
## Combustion and Fuels

**Learning time:** 6h  
Theory classes: 6h

**Description:**  

## Lubrication

**Learning time:** 6h  
Theory classes: 6h

**Description:**  

## Forming the mixture

**Learning time:** 6h  
Theory classes: 6h

**Description:**  
Injection. Injection systems and elements.  

## Refrigeration

**Learning time:** 6h  
Theory classes: 6h

**Description:**  
Refrigerants. Systems and cooling elements.  

## Scavenging

**Learning time:** 6h  
Theory classes: 6h

**Description:**  
### Qualification system

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

\[ N_{\text{final}} = 0.7 \times N_{\text{pf}} + 0.3 \times N_{\text{elt}} \]

- **Nfinal**: final grade.
- **Npf**: final test score.
- **Nelt**: scores of teaching and laboratory work.

The final test consists of a part with issues related to the learning objectives of the course in terms of knowledge or understanding concepts, and a set of application exercises.

The rating of teaching and laboratory work will consist of technical reports delivery practices and / or jobs.

A final test will be conducted reassessment students who meet the requirements established by the regulations of the center, which will consist of a single test in which all of the matter that will be assessed during the course.

### Regulations for carrying out activities

If you have not done laboratory activities, work or evaluation, is considered not scored.

It is considered not submitted when not perform any tests.

---

**Motor starting.**

<table>
<thead>
<tr>
<th><strong>Learning time:</strong> 6h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 6h</td>
</tr>
</tbody>
</table>

**Description:**
- Systems and startup items.
- Reversible motors.
- Engine starting systems.
- Electric start.
- Pneumatic starter.
- Distributor boot.

**Supercharger.**

<table>
<thead>
<tr>
<th><strong>Learning time:</strong> 6h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 6h</td>
</tr>
</tbody>
</table>

**Description:**
- Supercharging systems and components.
- Supercharging systems.
- Types of compressors.
- Turbochargers.
- Multistage supercharging.
- EGR valve.
- Wastegate valve.
- Regulation.

**Rotary engines.**

<table>
<thead>
<tr>
<th><strong>Learning time:</strong> 6h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 6h</td>
</tr>
</tbody>
</table>

**Description:**
- Wankel engine.
- Quasiturbine.
- Radmax.
- Ripalda.
- Round Engine.
- Application of rotary engines.

---

**Learning time:**
- Theory classes: 6h

---

**Description:**
- Systems and startup items.
- Reversible motors.
- Engine starting systems.
- Electric start.
- Pneumatic starter.
- Distributor boot.

**Supercharging systems and components.**
- Supercharging systems.
- Types of compressors.
- Turbochargers.
- Multistage supercharging.
- EGR valve.
- Wastegate valve.
- Regulation.

**Wankel engine.**
- Quasiturbine.
- Radmax.
- Ripalda.
- Round Engine.

**Application of rotary engines.**
Bibliography

Basic:


Complementary:
