Course guide
280655 - 280655 - Internal Combustion Engines

Unit in charge: Barcelona School of Nautical Studies
Teaching unit: 742 - CEN - Department of Nautical Sciences and Engineering.
Degree: BACHELOR'S DEGREE IN MARINE TECHNOLOGIES (Syllabus 2010). (Compulsory subject).
Academic year: 2022
ECTS Credits: 9.0
Languages: Spanish

LECTURER

Coordinating lecturer: MANUEL RODRIGUEZ CASTILLO
Others: Segon quadrimestre: MANUEL RODRIGUEZ CASTILLO - DT, GTM

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
GTM.CE30. Ability to design and manage energy optimization systems applied to marine installations.

Transversal:
SCS N2. SUSTAINABILITY AND SOCIAL COMMITMENT - Level 2. Applying sustainability criteria and professional codes of conduct in the design and assessment of technological solutions.

STCW:
ME.1. A-III/1-1. Function: Marine engineering at the operational level
ME.2. A-III/1-1.4 Operate main and auxiliary machinery and associated control systems
ME.3. A-III/1-KUP 1.4.1.1 Basic construction and operation principles of machinery systems, including: .1 marine diesel engine
ME.4. A-III/1-KUP 1.4.1.9 Basic construction and operation principles of machinery systems, including: .9 fluid flow and characteristics of lubricating oil, fuel oil and cooling systems
ME.5. A-III/1-KUP 1.4.2 Safety and emergency procedures for operation of propulsion plant machinery, including control systems
ME.6. A-III/1-KUP 1.4.3.1 Preparation, operation, fault detection and necessary measures to prevent damage for the following machinery items and control systems: .1 main engine and associated auxiliaries
ME.7. A-III/1-KUP 1.4.3.3 Preparation, operation, fault detection and necessary measures to prevent damage for the following machinery items and control systems: .3 auxiliary prime movers and associated systems
ME.8. A-III/1-KUP 1.4.3.4 Preparation, operation, fault detection and necessary measures to prevent damage for the following machinery items and control systems: .4 other auxiliaries, including refrigeration, airconditioning and ventilation systems
ME.9. A-III/1-3. Function: Maintenance and repair at the operational level
ME.10. A-III/1-3.2 Maintenance and repair of shipboard machinery and equipment
ME.11. A-III/1-KUP 3.2.1 Safety measures to be taken for repair and maintenance, including the safe isolation of shipboard machinery and equipment required before personnel are permitted to work on such machinery or equipment
ME.12. A-III/1-KUP 3.2.2 Appropriate basic mechanical knowledge and skills
ME.13. A-III/1-KUP 3.2.3 Maintenance and repair, such as dismantling, adjustment and reassembling of machinery and equipment
ME.14. A-III/1-KUP 3.2.4 The use of appropriate specialized tools and measuring instruments
ME.15. A-III/1-KUP 3.2.6 Interpretation of machinery drawings and handbooks
ME.16. A-III/1-KUP 3.2.7 The interpretation of piping, hydraulic and pneumatic diagrams

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
      .2 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>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self study</td>
<td>135,0</td>
<td>60.00</td>
</tr>
<tr>
<td>Guided activities</td>
<td>10,0</td>
<td>4.44</td>
</tr>
<tr>
<td>Hours medium group</td>
<td>20,0</td>
<td>8.89</td>
</tr>
<tr>
<td>Hours large group</td>
<td>50,0</td>
<td>22.22</td>
</tr>
<tr>
<td>Hours small group</td>
<td>10,0</td>
<td>4.44</td>
</tr>
</tbody>
</table>

Total learning time: 225 h

CONTENTS

Application and classification of internal combustion engines (MCI).

Description:
Study on the different applications of internal combustion engines and ranking.

Full-or-part-time: 15h
Theory classes: 6h
Self study: 9h
**Fundamental concepts and general definitions of MCI.**

**Description:**
Schematic and nomenclature of the reciprocating engine. The engine ignition. The compression ignition engine. Differences between MECh and MEC. Working fluid.

**Full-or-part-time:** 15h  
Theory classes: 6h  
Self study : 9h

**Thermal cycles.**

**Description:**

**Full-or-part-time:** 15h  
Theory classes: 6h  
Self study : 9h

**Engine operating cycles two and four times.**

**Description:**
Indicated cycle and mean pressure indicated. Differences between actual and theoretical cycles. Study diagram indicated. Pressure diagram.

**Full-or-part-time:** 15h  
Theory classes: 6h  
Self study : 9h

**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

**Full-or-part-time:** 15h  
Theory classes: 6h  
Laboratory classes: 3h  
Self study : 6h
## Calculation of powers, yields and consumptions.

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

**Full-or-part-time:** 15h  
Theory classes: 6h  
Self study : 9h

## 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  

**Full-or-part-time:** 15h  
Theory classes: 6h  
Self study : 9h

## Combustion and Fuels.

**Description:**

**Full-or-part-time:** 15h  
Theory classes: 6h  
Self study : 9h

## Lubrication.

**Description:**

**Full-or-part-time:** 15h  
Theory classes: 6h  
Self study : 9h
Forming the mixture.

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

**Full-or-part-time:** 15h
Theory classes: 6h
Self study: 9h

Refrigeration.

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

**Full-or-part-time:** 15h
Theory classes: 6h
Self study: 9h

Scavenging

**Description:**

**Full-or-part-time:** 15h
Theory classes: 6h
Self study: 9h

Motor starting.

**Description:**
Systems and startup items. Reversible motors.

**Full-or-part-time:** 15h
Theory classes: 6h
Self study: 9h

Supercharger.

**Description:**
Supercharging systems and components.

**Full-or-part-time:** 15h
Theory classes: 6h
Self study: 9h
Rotary engines.

Description:

Full-or-part-time: 15h
Theory classes: 6h
Self study: 9h

GRADING SYSTEM

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

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

\( N_{\text{final}} \): final grade.
\( N_{\text{pf}} \): final test score.
\( N_{\text{elt}} \): 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.

EXAMINATION RULES.

If you have not done laboratory activities, work or evaluation, is considered not scored.
It is considered not submitted when not perform any tests.
BIBLIOGRAPHY

Basic:

Complementary:
- Ingeniería naval : revista editada por la Asociación de Ingenieros Navales de España. Madrid: Asociación de Ingenieros Navales de España, [1929].

RESOURCES

Other resources: