### 280724 - Combined Cycles and Cogeneration

**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 THE MANAGEMENT AND OPERATION OF MARINE ENERGY FACILITIES (Syllabus 2016). (Teaching unit Compulsory)  
**ECTS credits:** 5  
**Teaching languages:** Spanish

#### Teaching staff
**Coordinator:** GERMAN DE MELO RODRIGUEZ  
**Others:**  
Primer quadrimestre:  
GERMAN DE MELO RODRIGUEZ - 1

#### Opening hours
**Timetable:** Monday to Friday from 10:00 a.m. to 11:00 a.m. and Friday from 5:00 p.m. to 7:00 p.m.

#### Prior skills
Students will have to have knowledge of applied thermodynamics, and steam and gas turbines.

#### Requirements
Thermodynamics, marine turbomachines and steam generators.

#### Degree competences to which the subject contributes

**Basic:**
- CB6. Possess knowledge and understanding that provide a basis or opportunity to be original in the development and / or application of ideas, often in a research context.  
- CB9. That students can communicate their conclusions and the knowledge and latest rationale underpinning to specialists and non-specialty clearly and unambiguously.

**Specific:**
- CE1-MGOIEM. Coneixements adequats per iniciar l'activitat investigadora. Metodologia de la investigació aplicada a l'àmbit de l'espécialitat  
- CE3-MGOIEM. Capacitat per conèixer, entendre i utilitzar els principis de la cogeneració en instal·lacions marines  
- CE4-MGOIEM. Capacitat per conèixer, entendre i utilitzar els principis de les energies renovables en instal·lacions marines  
- CE5-MGOIEM. Capacitat per conèixer, entendre i utilitzar els principis d'inspecció i certificació d'instal·lacions marines  
- CE6-MGOIEM. Capacitat per conèixer, entendre i utilitzar els principis dels sistemes de generació, transport i distribució d'energia  
- CE8-MGOIEM. Coneixement i capacitat per optimitzar la gestió de sistemes de cogeneneració marins, així com els seus sistemes de generació, transport i distribució d'energia elèctrica  
- CE9-MGOIEM. Coneixement i capacitat per projectar operacions de manteniment de sistemes de cogeneneració marins,
280724 - Combined Cycles and Cogeneration

The objective of the subject of Combined Cycles, is fundamentally the knowledge at the management and operation level of the different combined cycles that can be carried out in practice with the current thermal machines and their thermal performances, which implies a broad knowledge of the cycles Thermal of Rankine, Brayton, Diesel, etc. the operation and operation of steam and gas turbines with all their elements, such as steam generators, heat recovery boilers of exhaust gases, condensers, etc.

Generical:

CE10MGOIEM. Coneixement i capacitat per optimitzar la gestió de sistemes de calor i fred
CE11MGOIEM. Coneixement i capacitat per projectar operacions de manteniment de sistemes de calor i fred
CE12MGOIEM. Coneixement i capacitat per optimitzar la gestió de màquines i motors tèrmics i hidràulics
CE13MGOIEM. Coneixement i capacitat per projectar operacions de manteniment de sistemes de màquines i motors tèrmics i hidràulics i màquines elèctriques marines
CE18MGOIEM. Coneixements d'auditories energètiques i mediambientals

Transversal:

CT1. ENTREPRENEURSHIP AND INNOVATION: Knowing and understanding the organization of a company and the sciences that govern the activity; be able to understand the business rules and relationships between planning, industrial and commercial strategies, quality and profit.
Know and understand the mechanisms that scientific research is based, as well as the mechanisms and instruments of transfer of results between different socio-economic actors involved in the processes of R + D + i.

Teaching methodology

*The subject is taught in three directions: master classes, practical exercise classes, and preparation and discussion of combined cycle innovation projects applicable to all types of ships.

Learning objectives of the subject

The objective of the subject of Combined Cycles, is fundamentally the knowledge at the management and operation level of the different combined cycles that can be carried out in practice with the current thermal machines and their thermal performances, which implies a broad knowledge of the cycles Thermal of Rankine, Brayton, Diesel, etc. the operation and operation of steam and gas turbines with all their elements, such as steam generators, heat recovery boilers of exhaust gases, condensers, etc.
280724 - Combined Cycles and Cogeneration

**Study load**

<table>
<thead>
<tr>
<th>Total learning time: 45h</th>
<th>Hours large group:</th>
<th>45h</th>
<th>100.00%</th>
</tr>
</thead>
</table>

**Content**

**COMBINED CYCLES AND COGENERATION**

**Description:**
- Introduction.
- Centralized generation systems.
- Thermodynamic foundations of the gas-steam cycles.
- The gas turbine cycle.
- The steam turbine cycle.
- Thermodynamic study of the combined gas-steam cycles.
- Combined gas-steam cycle of a pressure level.
- Combined gas-steam cycle of two pressure levels.
- Combined gas-steam cycle of three pressure levels.
- Cycles combined with reheating.
- Cycles combined with reheating and high pressure in one step.
- Technology of the main constituent elements and configurations of the combined cycles.
- Partial load performance.
- Cost maintenance costs.
- Reduction of polluting emissions.
- Technology of steam turbines used in gas-steam combined cycle plants.
- The heat recovery boiler with and without postburning.
- Comparison of a combined cycle power plant with other power generation plants.
- Cooling systems.
- Future trends.

**Related activities:**
In order to consolidate the acquired knowledge, students are required to carry out a project of a combined cycle of use of residual energy on a ship.

**Specific objectives:**
All the contents of the subject are explained in theoretical classes and in the cases that are feasible, practical exercises are carried out that consolidate the acquired knowledge.

**Qualification system**

60% of the final mark of the subject corresponds to a theoretical exam at the end of the semester.
30% of the final mark to the presentation of an innovative project of a combined cycle applied to a ship.
10% of the final mark for practical exercises.
Regulations for carrying out activities

The completion of the final exercise and practical exercises are proposed by the teacher of the subject. The innovative combined cycle project is agreed between the student and the teacher of the subject.

Bibliography

Basic:


Complementary: