## Course guide

### 280640 - 280640 - Applied Thermodynamics and Thermotechnics

**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).  
- BACHELOR'S DEGREE IN NAVAL SYSTEMS AND TECHNOLOGY ENGINEERING (Syllabus 2010). (Compulsory subject).  
**Academic year:** 2023  
**ECTS Credits:** 6.0  
**Languages:** Spanish  

### LECTURER

**Coordinating lecturer:** ANNA MUJAL COLILLES  
**Others:** Primer quadrimestre:  
- ERIC JOSÉ PASCUAL SOLDEVILLA - DT, GESTN, GTM  
- SERGIO IVÁN VELASQUEZ CORREA - DT, GESTN, GTM

### PRIOR SKILLS

It is necessary for the student to have a fluent mathematical domain (solving equations, systems of equations, total derivatives, partial derivatives, definite integrals, indefinite integrals and ordinary differential equations)

### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

**Specific:**  
- GTM.18. Knowledge of applied thermodynamics and heat transfer.  

**Transversal:**  
- TLG. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.

**STCW:**  
- ETO.1. A-III/6-1. Function: Electrical, electronic and control engineering at the operational level  
- ETO.2. A-III/6-1.1 Monitor the operation of electrical, electronic and control systems  
- ETO.3. A-III/6-KUP 1.1.2 Basic knowledge of heat transmission, mechanics and hydromechanics

### TEACHING METHODOLOGY

- A large part of the teaching methodology followed is of lectures in which the theory is developed.  
- Other important part of the teaching methodology used is the case study. Problems arise which are analyzed, reflected and resolved. Students are invited to participate in these classes as it facilitates the learning of the whole classroom.  
- The students are proposed to solve exercises and problems, in order to be able to apply the theory of the subject. This is the first step in developing problem-based learning.  
- The students will be provided with tables and thermodynamic tools for the interactive resolution of the problems exposed in class.
LEARNING OBJECTIVES OF THE SUBJECT

· To acquire knowledge of applied thermodynamics and be able to perform thermodynamic calculations and apply them to the materials that require it.
· To know the basics of heat transmission.
· To apply with solvency the concepts of heat transmission in the materials that require it.
· To study with books and articles in English and write a report or technical work in English.
· To provide the student with the ability to analyze the behaviour of basic power and cooling cycles.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours medium group</td>
<td>28.0</td>
<td>18.67</td>
</tr>
<tr>
<td>Hours small group</td>
<td>2.0</td>
<td>1.33</td>
</tr>
<tr>
<td>Hours large group</td>
<td>30.0</td>
<td>20.00</td>
</tr>
<tr>
<td>Self study</td>
<td>90.0</td>
<td>60.00</td>
</tr>
</tbody>
</table>

Total learning time: 150 h

CONTENTS

1. Heat Transfer

Description:
Definition and mechanisms. Energy conservation principle

Full-or-part-time: 6h
Practical classes: 2h
Self study: 4h

2. Conducción

Description:

Full-or-part-time: 29h
Theory classes: 5h
Practical classes: 7h
Self study: 17h

3. Convección

Description:

Full-or-part-time: 3h
Theory classes: 1h
Self study: 2h
4. Radiación

**Description:**

**Full-or-part-time:** 18h
Theory classes: 4h
Guided activities: 4h
Self study: 10h

5. Heat Exchangers

**Description:**
A heat exchanger is a device for transferring heat energy from a fluid or substance at higher temperature to one of lower. The purpose of these devices is to prepare a substance or quantity of matter for various purposes, entrance to a process, an environment conditioning, heat removal systems that should remain at a constant temperature, evaporate or condense substances, etc.

**Full-or-part-time:** 10h
Theory classes: 1h
Guided activities: 2h
Self study: 7h

6. Conceptos básicos de Termodinamica

**Description:**

**Full-or-part-time:** 4h
Theory classes: 1h
Self study: 3h

7. Propiedades de las sustancias puras

**Description:**

**Full-or-part-time:** 3h
Theory classes: 1h
Self study: 2h

8. Análisis de energía en sistemas cerrados

**Description:**

**Full-or-part-time:** 10h
Theory classes: 1h
Guided activities: 2h
Self study: 7h
9. Análisis de masa y energía en volúmenes de control

Description:

Full-or-part-time: 14h
Theory classes: 2h
Guided activities: 4h
Self study : 8h

10. Segunda ley de la Termodinámica

Description:

Full-or-part-time: 19h
Theory classes: 3h
Guided activities: 5h
Self study : 11h

11. Entropy

Description:

Full-or-part-time: 20h
Theory classes: 4h
Guided activities: 5h
Self study : 11h

12. Power cycles

Description:
Power cycles are cycles which convert some heat input into a mechanical work output. Thermodynamic power cycles are the basis for the operation of heat engines, which supply most of the world's electric power and run the vast majority of motor vehicles. Power cycles can be organized into two categories: real cycles and ideal cycles. Cycles encountered in real world devices (real cycles) are difficult to analyze because of the presence of complicating effects (friction). Some cycles to be studied are: Carnot, Rankine, Refrigeration, Stirling, Stirling, Brayton, Diesel, Otto

Full-or-part-time: 12h
Theory classes: 1h
Guided activities: 3h
Self study : 8h
GRADING SYSTEM

The final grade of the subject is the result from summing the partial evaluations as follows:

\[ N_{\text{final}} = 0.5 N_{\text{pf}} + 0.3 N_{\text{pp}} + 0.2 N_{\text{ac}} \]

- \( N_{\text{final}} \): Final grade
- \( N_{\text{pf}} \): Final exam grade
- \( N_{\text{pp}} \): Partial exam grade
- \( N_{\text{ac}} \): Continuous evaluation process (quizes, homeworks, etc.)

The minimum mark of the exams must be 3.5 to be able to pass the subject.

EXAMINATION RULES.

- The works required by the teacher must be delivered on the date indicated. All works delivered outside the indicated date will not be evaluated.
- It will be considered not presented to the student or student who does not attend the evaluable tests.
- All those works or partial tests not performed will be valued with a zero.

BIBLIOGRAPHY

**Basic:**

**Complementary:**

RESOURCES

**Other resources:**
- NIST Chemistry WebBook
- NIST Standard Reference Database Number 69
- National Institute of Standards and Technology (NIST) Thermophysical Properties of Fluid Systems
- Access Link: https://webbook.nist.gov/chemistry/fluid/