Course guide

230462 - TERMO - Thermodynamics

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 748 - FIS - Department of Physics.
Degree: BACHELOR'S DEGREE IN ENGINEERING PHYSICS (Syllabus 2011). (Compulsory subject).
Academic year: 2022 ECTS Credits: 6.0 Languages: Catalan

LECTURER

Coordinating lecturer: Consultar aquí / See here:
https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/responsables-assignatura
Others: Consultar aquí / See here:
https://telecos.upc.edu/ca/estudis/curs-actual/professorat-responsables-coordinadors/professorat-assignat-idioma

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Ability to solve problems in thermodynamics, heat transfer and fluid mechanics, in the fields of physics, aerodynamics, geophysics and engineering.

General:
3. ABILITY TO IDENTIFY, FORMULATE, AND SOLVE PHYSICAL ENGINEERING PROBLEMS. Planning and solving physical engineering problems with initiative, making decisions and with creativity. Developing methods of analysis and problem solving in a systematic and creative way.

Transversal:
2. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.
1. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.

TEACHING METHODOLOGY

There will be three theoretical and two practical weekly sessions. The theoretical lectures will be devoted to a careful presentation of the basic concepts and the main results which will be illustrated with some examples. The practical sessions will be devoted to the solution of a variety of exercises and problems.

LEARNING OBJECTIVES OF THE SUBJECT

* Comprehension of basical principles in which thermodynamics is based
* Applications of these concepts to the solving of practical problems
* Comprehención of the link with other fields in physics and engineering
STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>65,0</td>
<td>43.33</td>
</tr>
<tr>
<td>Self study</td>
<td>85,0</td>
<td>56.67</td>
</tr>
</tbody>
</table>

Total learning time: 150 h

CONTENTS

1. Basic concepts

Description:

**Full-or-part-time:** 9h 11m
- Theory classes: 2h 30m
- Practical classes: 1h 36m
- Self study: 5h 05m

2. Monocomponent simple systems

Description:

**Full-or-part-time:** 19h 12m
- Theory classes: 5h 50m
- Practical classes: 3h 12m
- Self study: 10h 10m

3. Calorimetry and heat propagation

Description:

**Full-or-part-time:** 17h 13m
- Theory classes: 4h 10m
- Practical classes: 1h 36m
- Self study: 11h 27m
4. First law of thermodynamics

**Description:**
Expansion work on simple systems PVT. Dissipative work. Conjugate variables and configuration work on other simple systems: work surface, working torque, electric and magnetic polarization work. First Principle of Thermodynamics. Internal energy. Enthalpy.

**Full-or-part-time:** 14h 22m
Theory classes: 4h 20m
Practical classes: 2h 24m
Self study: 7h 38m

5. First law of thermodynamics: energetic properties and applications

**Description:**

**Full-or-part-time:** 13h 38m
Theory classes: 3h 36m
Practical classes: 2h 24m
Self study: 7h 38m


**Description:**

**Full-or-part-time:** 14h 22m
Theory classes: 4h 20m
Practical classes: 2h 24m
Self study: 7h 38m

7. Second law of thermodynamics: Entropy

**Description:**

**Full-or-part-time:** 11h 21m
Theory classes: 3h
Practical classes: 2h
Self study: 6h 21m
8. First and second law in open systems

Description:

Full-or-part-time: 18h 10m
Theory classes: 4h 48m
Practical classes: 3h 12m
Self study: 10h 10m

9. Thermodynamic potentials

Description:

Full-or-part-time: 14h 21m
Theory classes: 4h 19m
Practical classes: 2h 24m
Self study: 7h 38m

10. Phase transition in monocomponent systems

Description:

Full-or-part-time: 13h 38m
Theory classes: 3h 36m
Practical classes: 2h 24m
Self study: 7h 38m

11. Absolut zero and third law of thermodynamics

Description:
Inaccessibility of absolute zero. Postulates of Nernst and Planck statement of the third law of thermodynamics. Thermodynamic properties near absolute zero. Summary of the principles of thermodynamics from an axiomatic point of view.

Full-or-part-time: 4h 32m
Theory classes: 1h 12m
Practical classes: 0h 48m
Self study: 2h 32m

GRADING SYSTEM

There will be a final exam (EF) and a partial exam (EP). The students' participation in practical sessions will be also taken into account (P). The final score will follow from \[ \text{max}(\text{EF}, 0.65*\text{EF} + 0.30*\text{EP} + 0.05*\text{P}) \]
BIBLIOGRAPHY

Basic:

Complementary: