230462 - TERMO - Thermodynamics

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering
Teaching unit: 748 - FIS - Department of Physics
Academic year: 2018
Degree: BACHELOR'S DEGREE IN ENGINEERING PHYSICS (Syllabus 2011). (Teaching unit Compulsory)
ECTS credits: 6
Teaching languages: Catalan

Teaching staff
Coordinator: LUIS CARLOS PARDO SOTO
Others: JOSE LUIS TAMARIT MUR

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:
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.
2. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.

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
* Comprehension of the link with other fields in physics and engineering

Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group: 65h</th>
<th>43.33%</th>
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</thead>
<tbody>
<tr>
<td>Self study:</td>
<td>85h</td>
<td>56.67%</td>
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# 230462 - TERMO - Thermodynamics

## Content

1. **Basic concepts**

   **Description:**

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

2. **Monocomponent simple systems**

   **Description:**

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

3. **Calorimetry and heat propagation**

   **Description:**

   **Learning 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.

   **Learning 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:**

**Learning time:** 13h 38m  
Theory classes: 3h 36m  
Practical classes: 2h 24m  
Self study: 7h 38m

## 6. Second law of thermodynamics: Heat engines

**Description:**

**Learning time:** 14h 22m  
Theory classes: 4h 20m  
Practical classes: 2h 24m  
Self study: 7h 38m

## 7. Second law of thermodynamics: Entropy

**Description:**

**Learning time:** 11h 21m  
Theory classes: 3h  
Practical classes: 2h  
Self study: 6h 21m

## 8. First and second law in open systems

**Description:**

**Learning time:** 18h 10m  
Theory classes: 4h 48m  
Practical classes: 3h 12m  
Self study: 10h 10m
# 230462 - TERMO - Thermodynamics

## 9. Thermodynamic potentials

**Learning time:** 14h 21m  
Theory classes: 4h 19m  
Practical classes: 2h 24m  
Self study: 7h 38m

**Description:**  

## 10. Phase transition in monocomponent systems

**Learning time:** 13h 38m  
Theory classes: 3h 36m  
Practical classes: 2h 24m  
Self study: 7h 38m

**Description:**  

## 11. Absolut zero and third law of thermodynamics

**Learning time:** 4h 32m  
Theory classes: 1h 12m  
Practical classes: 0h 48m  
Self study: 2h 32m

**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.

## Qualification 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 $\max\{EF, 0.65*EF + 0.30*EP + 0.05*P\}$.
230462 - TERMO - Thermodynamics

Bibliography

Basic:


Complementary:

