820325 - GETF - Thermal and Fluid Dynamic Power Generation

Coordinating unit: 295 - EEBE - Barcelona East School of Engineering
Teaching unit: 729 - MF - Department of Fluid Mechanics
Academic year: 2017
Degree: BACHELOR'S DEGREE IN ENERGY ENGINEERING (Syllabus 2009). (Teaching unit Compulsory)
ECTS credits: 6
Teaching languages: Catalan

Degree competences to which the subject contributes

To know the operation and the dimensioning of heat engines and hydraulic and heat transfer equipment commonly used in industry.

Others: Joan Grau, Pere Rufes, Andrés Andreatta, Vicente Bitrian

Coordinator: Joan Grau

Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group: 45h</th>
<th>Hours medium group: 0h</th>
<th>Hours small group: 15h</th>
<th>Guided activities: 0h</th>
<th>Self study: 90h</th>
</tr>
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<td>30.00%</td>
<td>0.00%</td>
<td>10.00%</td>
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Learning objectives of the subject

To know the operation and the dimensioning of heat engines and hydraulic and heat transfer equipment commonly used in industry.

Teaching methodology

The course content will develop a methodology and participatory exhibits when taught the theoretical content. Students will work individually to make the understanding, analysis and synthesis of theory. In addition, teamwork will be necessary to address complex problems (theoretical and laboratory).

Requirements

Prerequisite: Fluid Mechanics (MF) and Thermodynamics and Heat Transfer (TTC)

CEENE-190. (ENG) Analizar los principios de operación de centrales termofluidodinámicas.

CEENE-13. Analyse the principles of operation of generators and boilers.

3. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 2. Using strategies for preparing and giving oral presentations. Writing texts and documents whose content is coherent, well structured and free of spelling and grammatical errors.
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## Content

**- 1. Thermal generation: Combustion. Steam boilers. Solar thermal energy applications.**

<table>
<thead>
<tr>
<th>Learning time:</th>
<th>36h</th>
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<tbody>
<tr>
<td>Theory classes:</td>
<td>12h</td>
</tr>
<tr>
<td>Laboratory classes:</td>
<td>2h 30m</td>
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<tr>
<td>Self study</td>
<td>21h 30m</td>
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**Description:**

**Related activities:**
Laboratory: Solar Thermal Installation

**Specific objectives:**
After completing this section, the student will recognize different heat generation systems, including the use of fuels and solar radiation in thermal systems. The student will also be able to perform basic design tasks for heat generation systems.

**- 2. Hydraulics machines. Turbomachines and volumetrics machines**

<table>
<thead>
<tr>
<th>Learning time:</th>
<th>27h 30m</th>
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<tbody>
<tr>
<td>Theory classes:</td>
<td>9h</td>
</tr>
<tr>
<td>Laboratory classes:</td>
<td>2h</td>
</tr>
<tr>
<td>Self study</td>
<td>16h 30m</td>
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</tbody>
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**Description:**

**Related activities:**
Laboratory: Pelton turbine

**Specific objectives:**
Get classification criteria of the hydraulic machines. Knowing the kinematics of flow in the impeller of turbomachines and their influence on energy transfer in the impeller. Understand the different types of pumps, their essential functional elements and their application areas. Understand the different types of turbines, their essential functional elements and their operating environments. Knowing how to use the similarity to redesign pumps and turbines similar to other existing

<table>
<thead>
<tr>
<th>Learning time: 26h 30m</th>
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<tbody>
<tr>
<td>Theory classes: 6h</td>
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<tr>
<td>Laboratory classes: 4h 30m</td>
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<tr>
<td>Self study: 16h</td>
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</tbody>
</table>

**Description:**

**Related activities:**
- Laboratory: Heat exchanger, experimental and numerical study (2 sessions)

**Specific objectives:**
- After completing this section the student will understand the operation and basic design principles of heat exchangers, the thermodynamics of moist air and its application to the design of cooling towers.


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<th>Learning time: 15h</th>
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<tr>
<td>Theory classes: 6h</td>
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<tr>
<td>Self study: 9h</td>
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**Description:**

**Related activities:**
- Laboratory: alternative compressor

**Specific objectives:**
- After completing this section, the student will recognize different gas power generation cycles and equipments and the required criteria to perform basic design tasks.

Learning time: 25h
Theory classes: 6h
Laboratory classes: 4h
Self study: 15h

Description:

Related activities:
Laboratory: Thermal power plant I and II (2 sessions)

Specific objectives:
After completing this section, the student will recognize different steam power generation cycles and equipment and the required criteria to perform basic design tasks.

- 6. Refrigeration cycles and heat pumps.

Learning time: 20h
Theory classes: 6h
Laboratory classes: 2h
Self study: 12h

Description:

Related activities:
Laboratory: Heat pump

Specific objectives:
After completing this section, the student will recognize different refrigeration cycles and equipment and the required criteria to perform basic design tasks.

Qualification system

The evaluation will be conducted through written tests in the partials and final tests. The exercises and problems will be assessed from the delivery of material by students. Practices will be assessed based on attendance and activity performed in the laboratory together with the preparation and delivery of practice reports.
The students will be carried out an interdisciplinar project together with other subjects of the specialty.

Partials tests: 20%
Exercises / problems: 10%
Practices: 15%
Final test: 25%
Generical competence: 5%
Interdisciplinar project: 30 %
A necessary condition to pass the subject is attending all practices and the completion and delivery of the reports. The subject have a reevaluation test, following the conditions defined in the academic regulations.
Bibliography

Basic:


