Degree competences to which the subject contributes

Specific:
1. Knowledge and skills for the design and analysis of heat engines and machines, hydraulic machines and installations of heating and cooling industry.

Teaching methodology

The course is divided into three parts:
1. Sessions to present content.
2. Sessions for practice (exercises, problems and laboratory).
3. Self study, exercises and activities.

In the content of the sessions, teachers will introduce the theoretical foundations of the subject, concepts and methods, using appropriate examples to facilitate understanding.

In the practical sessions, teachers will guide students in applying theoretical concepts and using critical reasoning. We propose that students solve exercises in the classroom and outside the classroom, to promote contact and use the basic tools needed to solve the problems.

Students, independently, will work with material provided by the teacher to fix and assimilate concepts. The teachers provide a curriculum and monitoring activities (ATENEA).

Learning objectives of the subject

The course is divided into three modules or themes:
1) Fluid Engineering: Hydraulic machines and systems (2.5 ECTS)
2) Thermal Engineering: Industrial heating and cooling systems (2.5 ECTS)
3) Thermal Engineering: Heat engines (2.5 ECTS)

Hydraulic systems and machines
Study of operating principles, technology and applications of basic hydraulic machines, as well as various equipment and facilities of hydraulic systems.

Students should know the types of machines studied, scope and operation, and the basic criteria used in engineering selection. Students should also dominate the interaction between the machine and the system to which is connected, and how to act to change the operating point. Finally, students should be aware of the common operation problems and how to avoid them.

Industrial heating and cooling systems
Study of operating principles, technology and applications of the main equipment and systems used for industrial heating and cooling. The student must know how to use the energy balances to determine the efficiency and performance of the equipment and systems studied. At the same time should know the types of applications and limitations of use of each system, focusing especially on the environmental impact that its use may produce.

Heat engines
Study of operating principles, technology and applications of heat engines. The heat engine can generate mechanical energy, based on the energy content of a fluid (usually heat generated by combustion). The main applications of this equipment focus on transport, the operation of machinery and the generation of electrical energy.

In a similar way to the heating and cooling systems, the student must know how to use the energy balances to determine the efficiency and performance of the equipment studied. At the same time should know the types of applications and limitations of use of each equipment, focusing especially on the environmental impact that its use may produce.

### Study load

<table>
<thead>
<tr>
<th>Total learning time: 187h 30m</th>
<th>Hours large group: 45h 24.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours medium group: 0h 0.00%</td>
<td></td>
</tr>
<tr>
<td>Hours small group: 22h 30m 12.00%</td>
<td></td>
</tr>
<tr>
<td>Guided activities: 0h 0.00%</td>
<td></td>
</tr>
<tr>
<td>Self study: 120h 64.00%</td>
<td></td>
</tr>
</tbody>
</table>
## Content

<table>
<thead>
<tr>
<th>Module 1: Hydraulic machines and systems</th>
<th>Learning time: 62h 30m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 15h</td>
<td>Laboratory classes: 7h 30m</td>
</tr>
<tr>
<td>Self study : 40h</td>
<td></td>
</tr>
</tbody>
</table>

**Description:**
- Previous concepts.
- Systems with turbomachinery. Operating point.
- Dimensionless groups and similarity theory models.
- Regulation. Control valves. Types and selection

<table>
<thead>
<tr>
<th>Module 2: Industrial heating and cooling systems</th>
<th>Learning time: 62h 30m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 15h</td>
<td>Laboratory classes: 7h 30m</td>
</tr>
<tr>
<td>Self study : 40h</td>
<td></td>
</tr>
</tbody>
</table>

**Description:**
- Heat exchangers
- Fuels and combustion
- Refrigeration equipment
- Heat generators

<table>
<thead>
<tr>
<th>Module 3: Heat engines</th>
<th>Learning time: 62h 30m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory classes: 15h</td>
<td>Laboratory classes: 7h 30m</td>
</tr>
<tr>
<td>Self study : 40h</td>
<td></td>
</tr>
</tbody>
</table>

**Description:**
- Internal combustion engines
- Steam turbines
- Gas turbines
- Combined heat and power systems

## Qualification system

A
Bibliography

Basic:


