

Academic Year: ( 2019 / 2020 )

Review date: 10-04-2019

Department assigned to the subject: Department of Thermal and Fluids Engineering

Coordinating teacher: LIZARTE MAYO, RAQUEL

Type: Electives ECTS Credits : 6.0

Year : 4 Semester :

**STUDENTS ARE EXPECTED TO HAVE COMPLETED**

Thermodynamics  
Heat transfer

**COMPETENCES AND SKILLS THAT WILL BE ACQUIRED AND LEARNING RESULTS.**

The aim of this course is to understand the modern technologies for refrigeration and air-conditioning and their implementation in the tertiary and residential sectors.

To attain this objective, the student has to acquire knowledge, competences and skills.

With regard to knowledge, at the end of the course the student must be able to:

1. Know the current regulations related to air-conditioning for buildings.
2. Know different types of air-conditioning systems for the residential and tertiary sectors.
3. Address freezing chambers: enclosure and cooling systems.
4. Determine the efficiency of cooling and heating systems.
4. Be aware of their environmental impact.

With regard to the competences, the student will acquire specific and general abilities or skills. The specific skills are:

1. Application of regulations: energy certification for buildings, the Technical building code, the regulation of thermal installations in buildings. Calculate thermal loads and determine the presence of water condensed on walls.
2. Identify the elements of air-conditioning facilities: energy sources, heat exchangers, pumps, fans, terminal elements, auxiliary elements.  
Tell the difference between vapour-compression refrigeration systems and absorption cooling systems. Calculate hot water demands.
4. Design freezing chambers.
5. Calculate thermal efficiencies for air-conditioning systems and refrigeration systems.
6. Determine the environmental impact of the refrigerants.

In terms of general abilities or skills, the following areas will be worked upon throughout the development of the subject:

1. Ability to solve engineering problems.
2. Ability to look for information and discriminate the relevant information to correctly characterize a facility from the Thermodynamic point of view.
3. Ability to work in a team

The attitudes developed will be:

1. A critical attitude towards identifying and evaluating the operation of basic equipment of a thermal facility.
2. A collaborative attitude that will allow obtain information and knowledge from other agents to perform complex tasks.

**DESCRIPTION OF CONTENTS: PROGRAMME**

The subject is divided into three main blocks:

Block 1: Regulations. Energy certification for buildings. Technical building Code. The basic DB HE Energy document. Thermal loads. Energy demand. Condensation on walls.

Block 2: Thermal facilities. Regulations on thermal installations in buildings. Air-conditioning systems: sources, terminals, auxiliary devices. Vapour compression systems in buildings. Air-cooled and water-cooled systems. Absorption cooling technology. Sanitary hot water. Radiators. Freezing chambers.

Thermodynamic cycles for freezing chambers.

Block 3: Environmental impact of thermal facilities. Refrigerants: Characteristics, environmental impact (Ozone Depletion, Global Warming Potential)

#### LEARNING ACTIVITIES AND METHODOLOGY

The learning methodology includes:

1. Lectures covering the main topics of the course. In order to facilitate the learning process the student will receive support material and information to let them focus on the relevant topics.
2. Resolution of problems at class with the student's participation, to consolidate their newly acquired knowledge.
3. Exercises solved by the student to self-assess their knowledge and acquire the necessary skills.
4. Lab sessions: Team-work and preparation of reports.
  - 1 session: Determine thermal loads
  - 2 sessions: Determine Energy demand and Energy consumption of a dwelling. Software programs.
  - 1 session: Freezing chamber. Operational parameters.

#### ASSESSMENT SYSTEM

A continuous evaluation system will be carried out where the following will be evaluated.

1. Problem solving. Resolution will be carried out individually.
2. Team work: Lab sessions. Elaboration of reports.
3. Final exam. Evaluation of students learning.

<b>% end-of-term-examination:</b>	60
<b>% of continuous assessment (assignments, laboratory, practicals...):</b>	40

#### BASIC BIBLIOGRAPHY

- Carrier Manual de aire acondicionado, Marcombo, 2009
- Fco Javier Rey Martínez, Eloy Velasco Bombas de calor y energías renovables en los edificios, Paraninfo, 2005