

Academic Year/course: 2022/23

66363 - Energy efficiency in thermal systems

Syllabus Information

Academic Year: 2022/23

Subject: 66363 - Energy efficiency in thermal systems

Faculty / School: 110 - Escuela de Ingeniería y Arquitectura

Degree: 636 - Master's in Renewable Energies and Energy Efficiency

ECTS: 6.0

Year: 1

Semester: First semester

Subject Type: Compulsory

Module:

1. General information

2. Learning goals

3. Assessment (1st and 2nd call)

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The learning process designed for this subject is based on the following points

In the **lectures**, the basic concepts are presented and applied with short exercises developed on the blackboard. This serves as support to assure the understanding of the concepts explained.

In the **practice sessions**, laboratory sessions are combined with computer practices, in which practical cases more complex than those presented on the board are studied.

The **guided assignments** are an expansion of the practice sessions, in which students will solve larger problems than those done in the practice sessions. The student will ask the lecturer those questions arising during the development of the assignment.

4.2. Learning tasks

The course includes the following learning tasks:

- A01 Lectures (45 hours). Presentation of theoretical contents by a faculty or by external experts to all students enrolled in the course.
- A02 Problem and case solving (5 hours). Solve practical problems and exercises with all the students.
- A03 Laboratory sessions (10 hours). Students will work actively in groups to solve practical exercises.
- A05 Guided assignments (10 hours).
- A07 Autonomous work (74 hours).
- A08 Assessment (6 hours).

The indicated hours are for guidance and may be adjusted depending on the academic calendar.

At the beginning of the course, lecturers will communicate the schedule of practice sessions, which will be set according to the syllabus and the availability of laboratories and computer rooms.

4.3. Syllabus

The course will address the following topics:

TOPIC 1. FUNDAMENTALS OF ENERGY EFFICIENCY IN THERMAL ENGINEERING

- Role of thermal systems for improving energy efficiency in facilities.
- Thermal insulation: materials, optimization of thickness, application of insulation.
- Heat recovery. Types and calculation of heat exchangers.
- Heat exchanger networks. Characteristics and fundamentals of their design.

TOPIC 2. COMBUSTION TECHNOLOGY AND ITS APPLICATIONS

- Basic thermodynamics (supplementary material).
- Mass and energy balance in combustion.
- Boilers. Classification and types. Fuels.
- Thermal efficiency in boilers. Calculations and methods.
- Energy savings in boilers.
- Energy savings in furnaces. Industrial experiences.

TOPIC 3. COOLING

- Cooling technologies depending on applications.
- Basic engineering in cooling installations.
- Refrigerants to use in cooling technologies.

TOPIC 4. POWER GENERATION

- Introduction to thermal turbomachinery: turbines and compressors.
- Integration of thermal machinery in power generation systems: steam cycles, gas turbines, internal combustion engines, fuel cells?

TOPIC 5. ENERGY EFFICIENCY IN BUILDINGS

- Fundamentals and Regulations on Energy Performance Certification: Certification procedures for new and existing buildings: general and simplified options. Rating scale and energy indicators. Basics of energy efficiency in buildings.
- Simplified Methodology for Energy Performance Certification of Existing Buildings - CE3X: General data. Definition of the thermal envelope and installations. Rating and assessment of improvements. Economic analysis and solution of practical exercises: residential, small and large tertiary buildings.

4.4. Course planning and calendar

Detailed information concerning the timetable, classroom, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the EINA website (eina.unizar.es).

The subject belongs to the first semester and has 6 ECTS. 3 hours per week are planned plus additional sessions for practice and exercises.