Universidad Zaragoza

66420 - Numerical and experimental methods in thermal engineering

Syllabus Information

Academic Year: 2022/23

Subject: 66420 - Numerical and experimental methods in thermal engineering

Faculty / School: 110 - Escuela de Ingeniería y Arquitectura

Degree: 536 - Master's in Mechanical Engineering

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 methodology followed in this course is oriented towards achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as:

1) Lectures, given to the whole group, where the teacher explains the basics of the course and solves some representative real problems useful for future professional practice. Student participation is encouraged. At the same time, autonomous work is necessary for a better use of the sessions.

2) Laboratory sessions and computer lab sessions, which are distributed throughout the semester and whose evaluation will be part of the final mark of the course. Groups of two students will be formed in order to encourage learning and teamwork.

3) Guided assignment in small groups (ideally in pairs): with a computer tool, students analyze and solve a problem of the course. This enhances independent study and learning and its application to find the solutions of the proposed exercises.

4) Exercises, questions and additional problems to those solved during classes. With these tools the autonomous work is encouraged, studying the topics and applying them to find the solutions of the proposed exercises. Although this activity is supervised by the teacher, self-execution is fundamental for the student learning process and for evaluation purposes.

5) In tutorials the teacher will provide student with certain procedures for the approach and problem-solving exercises. The use of these tutorials is highly recommended to ensure adequate progress in learning.

4.2. Learning tasks

The course includes the following learning tasks:

- Lectures (theory and problems)
- Laboratory sessions and Computer lab sessions (type 3)
- Practice sessions (type 6)

4.3. Syllabus

The course will address the following topics:

SECTION 1. EXPERIMENTAL TECHNIQUES

    Topic 1. Uncertainty: generation and propagation

    Measurement of basic thermal properties

    Topic 2. Temperature

    Measurement of basic thermophysical properties

    Topic 3. Specific heat and enthalpy

    Topic 4. Thermal conductivity

    Topic 5. Rheological properties

    Measurement of fuels and flue gases properties

    Topic 6. Flue gases detection and measurement techniques

    Topic 7. Measurement of basic fuel properties

    Topic 8. Applications

SECTION 2. NUMERICAL TECHNIQUES

    Topic 1. Differential equations of heat transport

    Topic 2. Numerical methods for rating/dimensioning problems

    Topic 3. Numerical methods in thermal radiation heat transfer

Laboratory sessions/Computer lab sessions

1. Temperature measurement
2. Specific heat and thermal conductivity of selected substances
3. Experimental determination of solid fuel properties: heating value, proximate composition and particle size distribution
4. CFD simulation of a diffusive-convective problem
5. CFD simulation of a radiative heat problem

4.4. Course planning and calendar

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course, will be provided on the first day of class.