66420 - Numerical and experimental methods in thermal engineering

Información del Plan Docente

Academic Year	2017/18
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

1.1.Introduction

1.2.Recommendations to take this course

1.3.Context and importance of this course in the degree

1.4.Activities and key dates

2.Learning goals

2.1.Learning goals

2.2.Importance of learning goals

3.Aims of the course and competences

3.1.Aims of the course

3.2.Competences

4.Assessment (1st and 2nd call)

4.1.Assessment tasks (description of tasks, marking system and assessment criteria)

5.Methodology, learning tasks, syllabus and resources

5.1.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**.**

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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.

5.2.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)

5.3.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

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Topic 7. Measurement of basic fuel properties

Topic 8. Applications

SECTION 2. NUMERICAL TECHNIQUES

Topic 1. Numerical methods in heat conduction

Topic 2. Numerical methods for rating/dimensioning thermal equipment

Topic 3. Numerical methods for rating/dimensioning thermal installations

Topic 4. 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

5.4.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.

5.5.Bibliography and recommended resources

- G. E. Myers, Analytical methods in conduction heat transfer / Glen E. Myers Schenectady, New York : Genium Publishing Corporation, cop. 1987
- G. Nellis. Heat transfer / Gregory Nellis, Sanford Klein Cambirdge: Cambridge University Press, 2009
- M. F. Modest, Radiative heat transfer / Michael F. Modest . - 3rd ed. Oxford [etc.] : Academic Press, 2013
- U. Grigull, H. Snadner, Heat Conduction HPC, 1984
- H.W. Coleman and W. G. Steele, Experimentation and Uncertainty Analysis for Engineers, 2nd Ed. Wiley, 1998
- Lipták, B.G. (ed.) Process Measurement and Analysis, Vol I., Instrument Engineers' Handbook, 4th Edition CRC Press 2003.
- J. G. Webster, Measurement, Instrumentation and sensors Handbook, CRC Press 1999