66420 - Numerical and experimental methods in thermal engineering

Información del Plan Docente

Academic Year	2016/17
Academic center	110 - Escuela de Ingeniería y Arquitectura
Degree	536 - Master's in Mechanical Engineering
ECTS	6.0
Course	1
Period	First semester
Subject Type	Compulsory
Module	---

1.Basic info

1.1.Recommendations to take this course

1.2.Activities and key dates for the course

2.Initiation

2.1.Learning outcomes that define the subject

2.2.Introduction

3.Context and competences

3.1.Goals

3.2.Context and meaning of the subject in the degree

3.3.Competences

3.4.Importance of learning outcomes

4.Evaluation

5.Activities and resources

5.1.General methodological presentation

The learning process designed for this course is based on the following main topics:

1) Lectures, given to the whole group, where the teacher explains the basics of the subject and solves some real representative problems useful for future professional practice. Students' involvement in this activity is encouraged. At the same time, self student work is necessary to better use of the lessons **.**

2) Laboratory sessions and computer lab sessions, which are distributed throughout the semester and whose evaluation

will be part of the final score of the course. Groups of two students will be formed in order to encourage learning and teamwork.

3) Work tutored in small groups (couples ideally): through a computer tool students analyze and solve a problem of the subject. This enhances independent studying, learning and applying it to the resolution 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 matter and applying it to the resolution of the proposed exercises. Although this activity is supervised by the teacher, self-execution is fundamental for the sturdent learning process and for evaluation purposes.

5) Academic tutorial: the teacher will provide student certain procedures for the approach and questions solving. The use of these tutorials is highly recommended to ensure adequate progress in learning.

5.2.Learning activities

The program offered to students to assist in achieving the expected results includes the following activities:

- Lectures (theory and problems)

- Laboratory sessions/Computer lab sessions (type 3)

- Practical sessions (type 6)

5.3.Program

SYLLABUS

- PART ONE- EXPERIMENTAL TECHNIQUES

1 - Uncertainty: generation and propagation

Measurement of basic thermal properties

2 - Temperature

Measurement of basic thermophysical properties

3 - Specific heat and enthalpy

4 - Thermal conductivity

5 - Rheological properties

Measurement of fuels and flue gases properties

6 - Flue gases detection and measurement techniques

7 - Measurement of basic fuel properties

8 - Aplications

- PART TWO - NUMERICAL TECHNIQUES

1 - Numerical methods in heat conduction

2 - Numerical methods for rating/dimensioning thermal equipment

3 - Numerical methods for rating/dimensioning thermal installations

4 - Numerical methods in thermal radiation heat transfer

Laboratory sessions/Computer lab sessions

1ª.- Temperature measurement

2ª.- Specific heat and thermal conductivity of selected substances

3ª.- Experimental determination of solid fuel properties: heating value, proximate composition and particle size distribution

4ª.- CFD simulation of a diffusive-convective problem

5ª.- CFD simulation of a radiative heat problem

5.4.Planning and scheduling

Since the very beginning teachers in charge of the course will provide students with the detailed timetable of the classes and the deadline of the work to be delivered during the semester

5.5.Bibliography and recomended 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, 2 nd Ed. Wiley, 1998

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- 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