Academic Year 11/12	SEL022	ADVANCED COURSE ON HEAT TRANSFER AND NUMERICAL METHODS
Department:	724 Heat Engines	
Coordinator:	Carlos David Pérez-Segarra	
Typology:	Block 1. Engineering Courses	Language: English
ECTS: 5	Offered in other degrees: MSc Energy Engineering (separate groups)	Year 1. Semester 2 Spring Semester

OBJECTIVES

- Strengthening on the basic aspects governing the heat and mass transfer phenomena (mathematical formulation, analytical techniques and numerical resolution).
- Introduction to the different methodologies for the numerical resolution of the mathematical formulation. Conversion of the mathematical models to numerical models and its resolution. Finite differences and Finite Volumes techniques. Approach to computational errors analysis techniques.
- Consolidation of the studied techniques in the resolution of combined multi-dimensional problems with conduction, convection and radiation in non participating media. Development of self-made codes for the study of the thermal and fluid dynamic behavior in cases which might be interesting for the students. Special emphasis is drawn to code verification, verification of the obtained numerical solutions and the validation of the used mathematical formulation.

COURSE DESCRIPTION

The course revises the mathematical formulation of the heat and mass transfer phenomena: transport equations (mass, momentum and energy conservation) and the constitutive laws for the molecular transport flow formulation (Stokes's, Fourier's and Fick's laws). Different techniques for their numerical resolution are introduced. Emphasis is put in the governing equations discretization methods using Finite Differences and Finite Volumes techniques (discretization meshes, numerical schemes,...), solution algorithm (coupled or segregated methods), resolution of the algebraic equations (direct methods, iterative methods and introduction to multi grid techniques). The student is introduced in the concepts of code verification (asserting an error free code) and numerical solution verification (computational errors estimation). The acquired knowledge is consolidated with the development of a self-made code for the resolution of combined problems (conduction, convection and radiation in non participating media) verifying the implemented code and the numerical solutions of the solved problems.

METHODOLOGY

Lectures and laboratory sessions (numerical practices)

COURSE EVALUATION

The student will conduct a midterm and a final exam. Additional the final grade will take in account:

- Implementation of a self-made code for the numerical resolution of combined problems of heat and mass transfer.
- Presentation and defense of verified numerical solutions of heat and mass transfer problems proposed during the course.

FACULTY

Carlos David Pérez-Segarra
http://directori.upc.edu/directori/dadesPersona.jsp?id=1001017