Advanced topics in fluid mechanics

Academic Year: (2019 / 2020) **Review date: 23-10-2018**

Department assigned to the subject: Department of Thermal and Fluids Engineering

Coordinating teacher: RUBIO RUBIO, MARIANO

Type: Compulsory ECTS Credits : 4.0

Year : 1 Semester : 1

STUDENTS ARE EXPECTED TO HAVE COMPLETED

Engineering Fluid Mechanics

COMPETENCES AND SKILLS THAT WILL BE ACQUIRED AND LEARNING RESULTS.

- Use of the conservation equations in their integral and differential form to solve relevant mechanical engineering problems.
- Use of dimensional analysis and nondimensionalization of the governing equations to simplify the mathematical models of fluid flow in a systematic and rational way.

DESCRIPTION OF CONTENTS: PROGRAMME

- Introduction. Basic concepts and hypotheses (continuum medium, local thermodynamic equilibrium, etc.).
- Kinematics of the flow field.
- Conservation equations in integral and differential form.
- Dimensional analysis. Similarity solutions.
- Laminar unidirectional and quasi-unidirectional flows in ducts and pipes.
- Low-Reynolds-number flows and hydrodynamic lubrication theory.
- High-Reynolds-number flows. Ideal flow.
- Boundary layer theory.
- Hydrodynamic stability and transition to turbulence.

LEARNING ACTIVITIES AND METHODOLOGY

- Seminars, including explanations of the basic theoretical aspects of the different subjects, as well as solutions to basic problems to illustrate the underlying theory (2 ECTS).
- Take-home exams, in which the student has to develop the solution to more complex problems demanding more time that a single lecture (2 ECTS).

To successfully solve the proposed problems, the student will use all the tools explained in the previous seminars.

ASSESSMENT SYSTEM

- Several take-home exams (50%).
- Final exam (50%).

% end-of-term-examination:	50
% of continuous assessment (assigments, laboratory, practicals…):	50

BASIC BIBLIOGRAPHY

- Antonio Barrero Ripoll y Miguel Pérez-Saborid Sánchez-Pastor Fundamentos y Aplicaciones de la Mecánica de Fluidos, McGraw-Hill, 2005
- Antonio Crespo Martínez Mecánica de Fluidos, Thomson, 2006
- G. K. Batchelor An introduction to fluid dynamics, Cambridge University Press, 1967
- H. Schlichting Boundary Layer Theory, McGraw-Hill, 1987
- L. D. Landau y E. M. Lifshitz Fluid Mechanics, Pergamon Press, 1989
- P. A. Lagerstrom Laminar Flow Theory, Princeton University Press, 1996
- P. G. Drazin y W. H. Reid Hydrodynamic Stability, Cambridge University Press, 2004
- S. B. Pope Turbulent Flows, Cambridge University Press, 2000