Engineering fluid mechanics

Academic Year: (2022 / 2023) **Review date: 13/06/2023 16:48:31**

Department assigned to the subject: Thermal and Fluids Engineering Department
Coordinating teacher: MORENO BOZA, DANIEL
Type: Compulsory ECTS Credits : 6.0
Year : 2 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Calculus I, II
Physics I, II
Linear Algebra
Writing and Communication Skills
Programming
Thermal Engineering
Machine Mechanics

OBJECTIVES

The objective of this course is to provide the student a basic understanding of Fluid Mechanics: Mass Conservation Law, Momentum Conservations Law and Energy Conservation Law.

Knowledge mastered in this course:
- Identify the fluid domain and understand the interaction with its surroundings.
- Apply properly the above mentioned conservation laws to obtain forces, moments, power and heat exchange.
- Determine the dominant terms in the conservation equations
- Determine the adequate methodology to obtain the required variables in an engineering problem (calculus, experiments, etc.)
- Present results in a rational manner, in terms of the relevant parameters.
- Comprehension of basic terminology to understand technical documentation and specific literature.

Specific capacities:
- Obtention of pressure fields in fluid statics.
- Determination of forces and moments exerted by a fluid on a surface.
- Determination of power and heat exchange between a fluid and its surroundings.
- Determination of head losses in flow in ducts.
- Aplication of Dimensional Analysis principles to reduce the number of parameters in a generic problem.

General capabilities:
- Analysis based on scientific principles.
- Multidisciplinar approach (use knowledge from several disciplines: Mechanics, Thermodynamics, Calculus, etc.)
- Capacity to locate and understand basic literature on the subject.

Attitudes:
- Analytical attitude
- Critical attitude
- Cooperative attitude

DESCRIPTION OF CONTENTS: PROGRAMME

Introductory course on Fluid Mechancis composed of:

1. Introduction to Fluid Mechanics: continuum hypothesis, local thermodynamic equilibrium, equations of state and definition of fluid variables.
2. Flow kinematics: Lagrangian and Eulerian description, convective flux, and Reynolds transport theorem.
3. Conservation laws: integral and differential forms of the continuity, momentum, and energy equations.
4. Dimensional analysis: Pi theorem and physical similarity.
5. 1D Flow: Couette, Poiseuille, and other flows of practical interest.
6. Flow in pipes: major and minor losses.
7. Introduction to external flows.

LEARNING ACTIVITIES AND METHODOLOGY

Teaching methodology will incluye:
1. Lectures: The students will be provided with lecture notes and recommended bibliography.
2. Problem solving sessions, related with the course topics
3. Homework problems aiming at student self-evaluation.
4. Development and interactive presentation of guided works, including four lab session as direct application of theory.

ASSESSMENT SYSTEM

% end-of-term-examination/test:	60
% of continuous assessment (assigments, laboratory, practicals…):	40

Continuous assessment will be based on the following criteria:

Partial exams: 2 eliminatory partial exams will be conducted throughout the course, which will cover material for the final ordinary exam. The weightage of each partial exam is 45% for the first one and 40% for the second one, based on the continuous assessment.
Laboratory practices: 4 practical sessions will be conducted, and students will submit the corresponding reports one week after each practice. The weightage of the practical grade is 15% of the continuous assessment.
All students who do not pass the continuous assessment associated with the partial exams must take the final exam, which will consist of the two previously evaluated parts. In the ordinary examination period, the final grade is calculated with 40% from the continuous assessment grade and 60% from the ordinary final exam grade.

In the extraordinary examination period, the final grade is determined either by 40% of the continuous assessment grade and 60% of the extraordinary final exam grade, or by 100% of the extraordinary final exam grade if the latter is higher than the former.

BASIC BIBLIOGRAPHY

- Antonio Crespo Martínez Mecánica de Fluidos, Thomson.
- Frank M. White Fluid Mechanics, McGraw Hill.
- MARCOS VERA COELLO, CARLOS MARTÍNEZ BAZÁN, ANTONIO L. SÁNCHEZ PÉREZ, IMMACULADA IGLESIAS ESTRADÉ Ingenieria Fluidomecanica, Paraninfo, 2012

ADDITIONAL BIBLIOGRAPHY

- A. L. Sánchez Apuntes de Procesos Fluidotérmicos, Publicaciones de la Universidad Carlos III de Madrid., 2005
- Amable Liñán Martínez Apuntes de Mecánica de Fluidos, Publicaciones de la ETSI Aeronáuticos de Madrid, 2006