DIM-SAP-353 Engineering Fluid Mechanics

SEMESTER: Spring
CREDITS: 6 ECTS (60 hours)
LANGUAGE: English
DEGREES: SAPIENS program

Course overview

This course provides an introduction to fluid mechanics. It examines the theoretical bases for fluid statics and dynamics including the conservation of mass, energy and momentum. It includes the governing integral and differential equations for viscous and inviscid fluids, in internal and external flows. Upon completion of this course, a good understanding of the theory and real applications of incompressible and compressible fluids will be achieved.

Prerequisites

Having passed a first year of bachelor's degree in engineering. Recommended: Thermodynamics.

Course contents

Theory:

1. Introduction to Fluid Mechanics. Concept of a Fluid. Properties of a fluid. Viscosity. Surface Tension.
2. Hydrostatics. Pressure Distribution in a Fluid. Pressure measurement. Plane and curved surfaces. Buoyancy and Stability.
3. Fluid dynamics I: Integral Relations for a Control Volume. The Reynolds Transport Theorem. Conservation of Mass. The Linear Momentum Equation. The Angular-Momentum Theorem. The Energy Equation. The Bernoulli's Equation.
4. Fluid dynamics II: Differential Relations for a Fluid Particle. The Acceleration Field of a Fluid. The Differential Equations of Mass Conservation, Linear and Angular Momentum; and Energy. Vorticity and Irrotationality.
5. Dimensional Analysis and Similarity. The Pi Theorem. Similitude.
6. Viscous Flow in Ducts. Reynolds-Number Regimes. Flow in circular and non- circular pipes. Losses.
7. Flow Past Immersed Bodies. Reynolds-Number and Geometry Effects. The Boundary-Layer Equations. Boundary Layers with Pressure Gradient. Experimental External Flows.
8. Compressible Flow. The Speed of Sound. Isentropic Flow with Area Changes. Shock Waves.
9. Open-Channel Flow. Uniform Flow. Chézy Formula. Efficient Uniform-Flow Channels. Hydraulic Jumps.

Textbook

- Çengel, Y. A., Cimbala, J. M., Fluid Mechanics: Fundamentals and Applications. McGraw Hill. 2012
- White, F. M. Fluid Mechanics. McGraw Hill. 2008
- Munson, Y., Okiishi, Fundamentals of Fluid Mechanics. 8th edition, Wiley, 2016

Grading

The following conditions must be accomplished to pass the course:

- A minimum overall grade of at least 5 over 10.
- A minimum grade in the final exam of 4 over 10.

The overall grade is obtained as follows:

- Final exam (50-60 %)
- Other exams (40%-30%).
- Participation in class exercises and debates (0-10%)

The extraordinary call consists of an exam covering the whole subject. The weight of this extraordinary exam could be 70% or 100%. The exam will only count 70% if other exams (30%) helps the student to get a better final grade. If these exams do not improve final grade, the extraordinary exam will value 100% of the final mark.