29716 - Fluid Mechanics

Información del Plan Docente

Academic Year	2018/19
Subject	29716 - Fluid Mechanics
Faculty / School	110 - Escuela de Ingeniería y Arquitectura
Degree	330 - Complementos de formación Máster/Doctorado 434 - Bachelor's Degree in Mechanical Engineering
ECTS	6.0
Year	XX
Semester	Indeterminate
Subject Type	Compulsory, ENG/Complementos de Formación
Module	---

1.General information

1.1.Aims of the course

1.2.Context and importance of this course in the degree

1.3.Recommendations to take this course

2.Learning goals

2.1.Competences

2.2.Learning goals

2.3.Importance of learning goals

3.Assessment (1st and 2nd call)

3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

The methodology followed in this course is oriented towards achievement of the learning objectives. It is based on participation and the active role of the student favors the development of communication and decision-making skills. A wide range of teaching and learning tasks are implemented, such as lectures, guided assignments, laboratory sessions, autonomous work, and tutorials.

Students are expected to participate actively in the class throughout the semester.

Classroom materials will be available via Moodle. These include a repository of the lecture notes used in class, the course syllabus, as well as other course-specific learning materials.

Further information regarding the course will be provided on the first day of class.

4.2.Learning tasks

The course includes 6 ECTS organized according to:

- Lectures (2 ECTS): 50 hours.

- Laboratory sessions (0.4 ECTS): 10 hours.

- Guided assignments (0.2 ECTS): 5 hours.

- Autonomous work (3.2 ECTS): 80 hours.

- Tutorials (0.2 ECTS): 5 hours.

Lectures: the professor will explain the theoretical contents of the course and solve illustrative applied problems. These problems and exercises can be found in the problem set provided at the beginning of the semester. Lectures run for 3 weekly hours. Although it is not a mandatory activity, regular attendance is highly recommended.

Laboratory sessions: sessions will take place every 2 weeks (5 sessions in total) and last 2 hours each. Students will work together in groups actively doing tasks such as practical demonstrations, measurements, experiments, and the use of graphical and analytical methods.

Guided assignments: students will complete assignments, problems and exercises related to concepts seen in laboratory sessions and lectures. They will be submitted at the beginning of every laboratory sessions to be discussed and analyzed. If assignments are submitted later, students will not be able to take the assessment test.

Autonomous work: students are expected to spend about 90 hours to study theory, solve problems, prepare lab sessions, and take exams.

Tutorials: the professor's office hours will be posted on Moodle and the degree website to assist students with questions and doubts. It is beneficial for the student to come with clear and specific questions.

4.3.Syllabus

1: Introduction

Definition of fluid; continuum hypothesis. Physical properties of fluids. Forces of surface and volume. The stress tensor . Study techniques of fluid flow. Classification of fluid flow.

2: Kinematics

Eulerian and Lagrangian descriptions. Substantial derivative. Characteristics lines in a flow. The velocity gradient tensor.

3: Fluidostatics

Fundamental equation of fluidostatics. Pressure and its measurement. Forces and torques on submerged surfaces.

4: Fundamental Equations of Fluid Mechanics

Fluid volume and volume control. Reynolds Transport Theorems. Continuity equation. Momentum equation. Equation of angular momentum. Bernoulli equation. Equations of energy. Turbulence

5: Dimensional analysis and similarity

Principle of dimensional homogeneity. Vaschy theorem Pi-Buckingham. Important dimensionless numbers in fluid mechanics. Adimensionalization of the fundamental equations. Similitude and modelling.

6: Unidirectional viscous flow

Introduction and equations. Couette flow. Hagen-Poiseuille flow. Hagen-Poiseuille axisymmetric flow. Couette rotating flow

7: Viscous flow in Ducts

Friction Head-losses. Darcy-Weisbach equation. Darcy friction factor in laminar and turbulent regimes. Minor Head-losses. Three types of Pipe-flow problems.

8: Open channel flow

Introduction. The One-Dimensional approximation. Uniform Flow; the Chezy formula. Specific Energy. Froude Number and Critical Depth. The Hydraulic Jump. Flow Measurement and Control by Weirs.

9: Boundary layer. Drag and Lift Forces

Boundary Layer equations. Parameters of the viscous boundary layer. Flat plate laminar flow: solution of Blasius. Von Karman integral equation. Turbulent boundary layer. Detachment of the boundary layer. Drag and Lift Forces

4.4.Course planning and calendar

For further details concerning the timetable, classroom and further information regarding this course please refer to the "Escuela de Ingeniería y Arquitectura " website (https://eina.unizar.es/)

4.5.Bibliography and recommended resources