Universidad Zaragoza

Academic Year/course: 2023/24

29625 - Fluid Mechanics

Syllabus Information

Academic year: 2023/24
Subject: 29625 - Fluid Mechanics
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 430 - Bachelor's Degree in Electrical Engineering
ECTS: 6.0
Year: 3
Semester: Second semester
Subject type: Compulsory
Module:

1. General information

1. General Information

The objective of the Fluid Mechanics subject is to train the student in its fundamentals and applications, and especially in those that are relevant to the degree. These approaches and objectives are aligned with some of those of the Sustainable Development Goals, SDGs, of the 2030 Agenda (https://www.un.org/sustainabledevelopment/es/) and certain goals, so that the acquisition of the learning results of the subject provides training and competence to the student to contribute to some extent to their achievement:

- **Goal 6**. Ensure the Availability and Sustainable Management of Water and Sanitation for All.
  - Target 6.4. By 2030, significantly increase the efficient use of water resources in all sectors and ensure the sustainability of freshwater abstraction and supply to address water scarcity and significantly reduce the number of people suffering from water scarcity.
- **Goal 8**. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.
  - Target 8.2. Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including by focusing on high value-added and labor-intensivesectors.
- **Goal 9**. Industry, Innovation and Infrastructure.
  - Target 9.5. Increase scientific research and improve the technological capacity of industrial sectors of all countries, particularly developing countries, including by fostering innovation and significantly increasing, by 2030, the number of people working in research and development per million inhabitants and public and private sector expenditures on research and development.
- **Goal 11**. Making cities and human settlements inclusive, safe, resilient and sustainable.
  - Target 11.5. By 2030, significantly reduce the number of deaths caused by disasters, including water-related disasters, and the number of people affected by disasters, and significantly reduce direct economic losses caused by disasters compared to global gross domestic product, with particular emphasis on protecting the poor and people in vulnerable situations.

2. Learning results

The student, in order to pass this subject, must demonstrate the following results.

1) Know how to describe a flow by means of its characteristic lines.

2) Interpret the physical meaning of conservation equations.

3) Know how to balance mass, forces, angular momentum and energy over control volumes.

4) Employ dimensional analysis techniques to design experiments and order-of-magnitude analysis to simplify problems.

5) Know the characteristics of the main flows of interest in engineering (external aerodynamics, duct flow, channel flow, boundary layer flow).

6) Know the principles of operation and the operation of basic instruments for measuring pressure, flow, velocity and viscosity.

7) Analyze and calculates pipe networks for fluid conduction. Apply Kirchhoff's laws for the solution, and respect the Darcy-Weisbach equation to achieve a proper final solution.

Importance of learning results

The student acquires basic knowledge about the behavior of fluids, and about the most relevant applications for their degree.

The student is able to make transcendental analogies to relate and apply knowledge of electrical circuits with the knowledge about the calculation of hydraulic circuits.

3. Syllabus

The program includes the study of the following topics:.

1. Introduction. Historical background and development of Fluid Mechanics.
2. Kinematics. Fluid flow description lines.
3. Forces in fluids. The stress tensor and its physical interpretation.
4. Fluidostatics. Rest.
5. Fundamental equations of Fluid Mechanics. Integral and differential equations.
6. Basic applications: laminar, unidirectional, and ideal fluid flow.
7. Dimensional analysis and similarity.
8. Fluid Instrumentation.
9. Duct flow. Linear losses and singular losses. Simple Fluid Networks.
10. Boundary layer and aerodynamics.

4. Academic activities

Planning of academic activities for the correct learning of the subject, and calendar of key dates.

Schedule of classroom sessions and presentation of works.

The theory and problem classes, as well as the practical sessions in the laboratory, are given according to the schedule established by the Center. The schedule for the latter will be announced at the beginning of the school year.

The professors' tutoring schedule is posted in their offices and in the Digital Teaching Ring.

The rest of the activities will be planned during the term, and will be announced well in advance in the Digital Ring.

The subject is composed of theory, problems, and practical and case studies.

- Theory and its application to problem solving are taught in the classroom. Each student receives a total of 3 hours per week, of which, the problem sessions will be done once the conceptsrequired for their correct analysis, reasoning and solution.
- There are a total of 10 hours of practice. At the end of each practical, the experimental data obtained are reviewed, and emphasizes on the correct analysis of the data to relate them to the theory seen in class. The student should bring a complementary, individual, and answer a series of questions that will allow him/her to confirm their knowledge.

Schedules are determined by the Center.

5. Assessment system

Type of tests and their value on the final grade, and assessment criteria for each test.

The student must demonstrate that they have achieved the expected learning results by means of the assessment activities.

1) Continuous assessment.

Students who opt for continuous assessment must pass 3 (three) exams, divided into three sections each:

1. Theory, with (approximately) 3 questions that can be purely theory or a brief practical explanation;
2. Two practical problems that demonstrate ability to apply the knowledge acquired;
3. Laboratory practices, with about 2 questions related to the practices carried out so far.

The final grade of the subject, in continuous assessment, is calculated as follows:

Final_grade=0.25*(average theory)+0.6*(average problems)+0.15*practicals