

## 30013 - Fluid Mechanics

### Syllabus Information

**Academic year:** 2024/25

**Subject:** 30013 - Fluid Mechanics

**Faculty / School:** 110 - Escuela de Ingeniería y Arquitectura

**Degree:** 436 - Bachelor's Degree in Industrial Engineering Technology

**ECTS:** 6.0

**Year:** 2

**Semester:** First semester

**Subject type:** Compulsory

**Module:**

### 1. General information

The objective of the Fluid Mechanics course, located in the first four-month period of the second year, is to provide the Degree in Industrial Technologies Engineering with the knowledge and skills related to the fundamentals of Fluid Mechanics as an Engineering discipline. . Given the generalist nature of the subject, the program is broad and mainly addresses basic aspects that will provide solid technical-scientific foundations and rigor.

Previous knowledge of Physics and Mathematics is required. In particular, it is necessary to know: the origin and meaning of forces and moments; properties of and operations with vectors and matrices; calculation of derivatives (total and partial) and integrals (definite and indefinite; surface and volume); differential operators such as the vector operator nabla in its different forms; physical meaning and manipulation of differential and integral equations.

Continued study and work are fundamental for the structured acquisition of knowledge and the passing of this subject.

The subject objectives are aligned with the following SDGs:

- Goal 6 (Ensure availability and sustainable management of water and sanitation for all), Target 6.4 Goal 8 (Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all, Target 8.2.
- Goal 9. (Industry, innovation and infrastructure), Target 9.5

### 2. Learning results

The following generic (1-3) and specific (4) competencies are acquired in the subject:

1. -Ability to solve problems and make decisions with initiative, creativity and critical thinking.
2. -Ability to use the techniques, skills and tools of Industrial Engineering necessary for its the practice.
3. -Ability to learn continuously and develop autonomous learning strategies.
4. -Knowledge of the basic principles of Fluid Mechanics. Application to problem solving in the field of Engineering.

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

- Know how to describe a flow by means of its characteristic lines, and understand the relationship between the different flow quantities.
- Interpret the physical meaning of conservation equations.
- Know how to balance mass, forces, angular momentum and energy over control volumes.
- Employ dimensional analysis techniques to design experiments and order of magnitude analysis to simplify problems .
- Know the characteristics of the main flows of interest in engineering (such as external aerodynamics, duct flow, boundary layer flow, thin film flow),
- Know the working principles and operation of basic instruments for measuring pressure, flow, velocity and viscosity.

### 3. Syllabus

#### Theory and problems program

Topic 1: Introduction

Topic 2: Fluid kinematics

Topic 3: Forces and fluid statics

Topic 4: Fundamental Equations of Fluid Mechanics

Topic 5: Dimensional analysis and similarity

Topic 6: Unidirectional viscous flow of liquids

Topic 7: Thin film flow

Topic 8: Boundary layer and aerodynamics

**Practical program:**

(This program is indicative; slight variations may occur)

Practice 1: Density and surface tension.

Practice 2: Viscosity.

Practice 3: Deposition discharge; interaction of a jet with solid surfaces

Practice 4: Aerodynamic tests on a reduced scale in a wind tunnel.

Practice 5: Flow in a channel.

#### 4. Academic activities

**Lectures** (fifty hours), given to the whole group, in which the professor will explain the basic principles of the subject and will solve some selected problems of application of the subject to the degree. Attendance and attention is highly recommended for a good performance.

**Laboratory practices** (ten hours), which are taught in small groups of students to work on each laboratory set-up a script previously handed out by the teachers and a questionnaire that collects the data taken and their analysis.

**Activities in small groups** and with student participation, aimed at explaining in more detail aspects of the theory and/or solving problems and practical cases.

**Autonomous work**, studying the material and applying it to the resolution of exercises.

**Tutorials**, for the resolution of doubts.

#### 5. Assessment system

The subject can be passed by means of continuous assessment or by means of a global test.

**Continuous assessment**, of a voluntary nature, is designed to encourage the student to consistently follow a subject which, by its nature and position in the curriculum, requires special attention. It consists of short controls throughout the course, in which the student must answer questions on theory and/or laboratory practices and/or solve problems. In general, in order to pass the subject, the student must pass each one of the controls.

The **overall test** consists of an exam with three parts: one part of theoretical questions, with a weight of approximately 30%; two problems, with a weight of approximately 60%; an exam of between three and five questions on practical exercises, with a weight of approximately 10%.

#### 6. Sustainable Development Goals

7 - Affordable and Clean Energy

9 - Industry, Innovation and Infrastructure

13 - Climate Action