

## 28815 - Fluid Engineering

### Syllabus Information

**Academic Year:** 2019/20

**Subject:** 28815 - Fluid Engineering

**Faculty / School:** 175 - Escuela Universitaria Politécnica de La Almunia

**Degree:** 424 - Bachelor's Degree in Mechatronic Engineering

**ECTS:** 6.0

**Year:** 2

**Semester:** Second semester

**Subject Type:** Compulsory

**Module:** ---

## 1.General information

### 1.1.Aims of the course

The principal aim of the subject is to get our students to acquire sufficient knowledge concerning both the concepts and those technical aspects linked to hydrostatic systems and systems of pressure piping.

### 1.2.Context and importance of this course in the degree

The subject of Engineering of Fluids is part of the present curriculum of Mechatronics Engineering at the EUPLA. This subject lasts a semester and is taught in the second year and consists of 6 ECTS credits. This subject is compulsory.

### 1.3.Recommendations to take this course

The subject Engineering of Fluids has no prior compulsory requirements. However, students taking the degree in Mechatronics are advised to have passed, or at least have taken, Mathematics I and II as well as Physics I and II.

## 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 the achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as:

Strong interaction between the teacher/student. This interaction is brought into being through a division of work and responsibilities between the students and the teacher. Nevertheless, it must be taken into account that, to a certain degree, students can set their learning pace based on their own needs and availability, following the guidelines set by the teacher.

The current subject Materials Engineering is conceived as a stand-alone combination of contents, yet organized into three fundamental and complementary forms, which are: the theoretical concepts of each teaching unit, the solving of problems or resolution of questions and laboratory work, at the same time supported by other activities.

The organization of teaching will be carried out using the following steps:

#### 1. Face-to-face generic activities:

- **Lectures:** The theoretical concepts of the subject are explained.

- **Practice Sessions:** Problems and practical cases are carried out.
- **Monitored Practices:** Exercises and practical cases are carried out, complementary to the theoretical concepts studied.

2. *Supervised Autonomous Activities:* These activities are carried out independently by students under the supervision of the teachers of the subject. The student will have questionnaires available per unit and suggested exercises and will be allowed to attend face-to-face or group tutorials to focus on solving them.

3. *Reinforcement activities:* Through the virtual learning portal (Moodle) or email of the University of Zaragoza, teachers of the subject will develop, for particular cases for which conventional tutoring cannot be applied, support and help activities for students who need it solving doubts or providing solutions to problems connected with the units covered.

## 4.2. Learning tasks

The course includes the following learning tasks:

- **Theory/Practice Lectures:** Theoretical activities or problems carried out mainly through exposition by the teacher.
- **Practical classes:** Theoretical discussion activities or exercises and practical cases presented by students
- **Practical laboratory testing:** This work is tutored by a teacher in the laboratory. These activities will continue with autonomous student work.
- **Individual tutorials:** These tutorials may be face-to-face or virtual (Moodle or email).
- **Group tutorials:** Scheduled tracking learning activities in which the teacher meets with a group of students to answer questions, exams or problems

The subject has 6 ECTS credits, which represents 150 hours of student work in the subject during the trimester, in other words, 10 hours per week for 15 weeks of class. 40% of this work (60h) will be held in the classroom and or lab and the rest will be autonomous.

A summary of a weekly timetable guide can be seen in the following table.

Activity	Weekly school hours
Lectures	2-3
Practical laboratory testing	1-2
Other Activities	6

There is a tutorial calendar timetable set by the teacher that can be requested by the students who want a tutorial.

## 4.3. Syllabus

The course will address the following topics:

### CONTENTS

- **THEORETICAL CONTENT**

#### 1. Introduction to Hydraulic engineering

Definition. Measurement units. Fluids properties (weight and mass, specific weight, specific or absolute density, relative density. Pressure. Manometers. Liquids and gases compressibility. Surface tension. Capillarity. Viscosity.

#### 2. Hydrostatics

Definition. Properties of hydrostatic pressure: direction and intensity. Pascal principle. General equation. Law of pressure variation. Archimedes principle. Hydrostatic forces on flat and curved surfaces.

#### 3. Fluids Kinematics

Definition. Kinematic parameters. Trajectory, tracer line, current line, flow line pipe. Classification of fluid.

#### 4. Fluids Dynamics.

Definition. Basic principles. The theorem of Bernouilli for ideal fluids, applications. Theoretical power of a hydraulic machine. Equation of motion. Dynamics of real fluids. Loss of charge. The real power of the hydraulic pump. The motion of real liquids in pipes.

#### 5. Hydraulic pumps, valves and water hammer

Hydraulic pumps and liquid pumping. Pump efficiency. Classification of hydraulic pumps. Valves and water hammer. Valve typology. Cavitation.

#### 6. Pressurized pipes and channels

Pressurized long pipe system. Design of a pressurized pipe system. Checking how a pressurized pipe system works. Practical formulae for hydraulic calculation of pressurized pipes. Open channel flow. Channels and parameters characteristic of flow. Equations.

### PRACTICAL CONTENTS

#### Problems

- 1.1 Compressibility of fluids
- 1.2 Hydrostatic systems, calculation of intensity, etc.
- 1.3 Fluids dynamics, the equation for conservation of energy, charge loss, etc.
- 1.4 Hydraulic pumps, water hammer, etc.
- 1.5 Pressurized pipe systems.

#### **Practice**

- 2.1 Manometers
- 2.2 Viscosity
- 2.3 Hydrostatic thrust
- 2.4 Osborne Reynolds apparatus
- 2.5 Venturi meter

#### **4.4.Course planning and calendar**

For the students in the continuous evaluation system, the written test will be held at the end of each section.

The final dates will be announced during the scholar year in the Moodle. The weekly schedule of the subject will be published at <http://www.eupla.unizar.es/asuntos-academicos/calendario-y-horarios>

The dates of the global evaluation test (official calls) will be published at <http://eupla.unizar.es/asuntos-academicos/examenes>

#### **4.5.Bibliography and recommended resources**

[http://biblos.unizar.es/br/br\\_citas.php?codigo=28815&year=2019](http://biblos.unizar.es/br/br_citas.php?codigo=28815&year=2019)