



## Course guide

### 820013 - MF - Fluid Mechanics

Last modified: 30/01/2024

**Unit in charge:** Barcelona East School of Engineering  
**Teaching unit:** 729 - MF - Department of Fluid Mechanics.

**Degree:** BACHELOR'S DEGREE IN BIOMEDICAL ENGINEERING (Syllabus 2009). (Compulsory subject).  
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Compulsory subject).  
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Compulsory subject).  
BACHELOR'S DEGREE IN ENERGY ENGINEERING (Syllabus 2009). (Compulsory subject).  
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Compulsory subject).  
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Compulsory subject).  
BACHELOR'S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Compulsory subject).

**Academic year:** 2023    **ECTS Credits:** 6.0    **Languages:** Catalan, Spanish

#### LECTURER

**Coordinating lecturer:** JOAN CALAFELL SANDIUMENGE - FRANCESCO CAPUANO - RICARDO JAVIER PRINCIPE RUBIO

**Others:** Primer quadrimestre:  
JOAN CALAFELL SANDIUMENGE - Grup: M31, Grup: M32, Grup: M33, Grup: M34, Grup: M35, Grup: M36, Grup: M37, Grup: T14  
FRANCESCO CAPUANO - Grup: M11, Grup: M12, Grup: M13  
ALBERTO ANTONIO CARBO BECH - Grup: M43, Grup: M44, Grup: M45, Grup: M46  
JOSE ALEJANDRO CARRILLO CORTES - Grup: M26, Grup: M27  
JOSE IGNACIO ESEBERRI PIEDRA - Grup: M37  
ATTILA PETER HUSAR - Grup: T11, Grup: T12, Grup: T13, Grup: T14, Grup: T15  
ALEJANDRO MARTINEZ ALEGRE - Grup: M25  
ROGER MAYNOU GIL - Grup: M23, Grup: M24  
RAUL OLEGARIO NAVARRETE ROMERO - Grup: T21, Grup: T22  
MARC OLLÉ BERNADES - Grup: M21, Grup: M22  
RICARDO JAVIER PRINCIPE RUBIO - Grup: M31, Grup: M32, Grup: M41, Grup: M42, Grup: T21, Grup: T22, Grup: T23, Grup: T24  
PEDRO RUFES MARTINEZ - Grup: T11, Grup: T12, Grup: T23, Grup: T24  
CARLOS RUIZ MOYA - Grup: M21, Grup: M22, Grup: M23, Grup: M24, Grup: M25, Grup: M26, Grup: M27, Grup: M33, Grup: M34, Grup: M35, Grup: M36, Grup: M41, Grup: M42, Grup: M43, Grup: M44, Grup: M45, Grup: M46, Grup: T15

Segon quadrimestre:  
JOAN CALAFELL SANDIUMENGE - Grup: M21, Grup: M22, Grup: M23, Grup: M24, Grup: M25  
FRANCESCO CAPUANO - Grup: M13, Grup: M14, Grup: T11, Grup: T12, Grup: T13, Grup: T14, Grup: T15  
DAIBEL DE ARMAS ORAMAS - Grup: T23, Grup: T24  
JOSE IGNACIO ESEBERRI PIEDRA - Grup: T11, Grup: T12  
ALFRED FONTANALS GARCIA - Grup: M11, Grup: M12  
ATTILA PETER HUSAR - Grup: T21, Grup: T22, Grup: T23, Grup: T24, Grup: T25  
ROGER MAYNOU GIL - Grup: T13, Grup: T14  
RICARDO JAVIER PRINCIPE RUBIO - Grup: M11, Grup: M12, Grup: M13, Grup: M14, Grup: M15, Grup: M21, Grup: M22, Grup: M25  
PEDRO RUFES MARTINEZ - Grup: T15, Grup: T21, Grup: T22, Grup: T25  
CARLOS RUIZ MOYA - Grup: M23, Grup: M24

## DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

### Specific:

2. Understand the basic principles of fluid mechanics and its application to problems in the field of engineering. Calculate the parameters of ducts, channels and fluid systems.

### Transversal:

1. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.

## TEACHING METHODOLOGY

The subject will be developed using master classes to present the contents to the students. The students will have to do individual work for problem solving and test preparing, and also team work for lab experiences and complex problem solving.

## LEARNING OBJECTIVES OF THE SUBJECT

Giving the students the knowledge and basic skills on this subject in order to prepare him for professional tasks related to the contents of it, and at the same time encouraging the training and learning processes in the field of fluid mechanics engineering.

## STUDY LOAD

Type	Hours	Percentage
Hours small group	15,0	10.00
Self study	90,0	60.00
Hours large group	45,0	30.00

**Total learning time:** 150 h

## CONTENTS

### 1. Fundamentals concepts. Fluid Properties.

#### Description:

Definition of fluid. Fluid as a continuous media. Fundamental properties. Viscosity.

#### Specific objectives:

Understanding the basic concepts of fluid mechanics. Identifying different kinds of problems in fluid mechanics. Applied knowledge of basic fluid properties and the influence of viscosity on friction in fluid flow.

**Full-or-part-time:** 21h 30m

Theory classes: 7h 30m

Laboratory classes: 1h

Self study : 13h

## 2. Hydrostatics.

### Description:

Pressure. Pascal's law. Pressure measurement. Hydrostatic forces over submerged surfaces. Flotation and stability. Fluids in motion as a rigid solid.

### Specific objectives:

Achieving the capacity to determine the pressure distribution in a still fluid, to calculate hydrostatic forces over flat and curved submerged surfaces and to determine the pressure distribution in fluids in motion as rigid solids.

**Full-or-part-time:** 18h 30m

Theory classes: 6h 30m

Laboratory classes: 1h

Self study : 11h

## 3. Basic concepts for flow analysis.

### Description:

Systems and control volumes. Eulerian and Lagrangian approaches. Material derivative. Flow classification. Visualization of a velocity field. Reynolds' transport theorem. Basic analysis techniques.

### Specific objectives:

Understanding the use of the material derivative for connecting the Eulerian and the Lagrangian approach, identifying different flow visualization techniques, understanding the use of Reynolds' transport theorem and knowing the differential, integral, experimental and computational techniques used for flow analysis.

**Full-or-part-time:** 10h 30m

Theory classes: 3h 30m

Laboratory classes: 1h

Self study : 6h

## 4. Basic integral equations in fluid mechanics (I).

### Description:

Continuity equation: massic and volumetric flow. Energy equation. Bernoulli equation. Scope and limitations. Velocity and flow rate meters.

### Specific objectives:

Correctly applying the concepts of compressibility and steadiness in flow determination. Identifying and correctly estimating the different forms of mechanical energy together with the efficiency in their transformations. Correctly using Bernoulli's equation in solving basic hydraulic problems and in velocity and flow rate meters.

**Full-or-part-time:** 40h 30m

Theory classes: 14h 30m

Laboratory classes: 1h

Self study : 25h

## 5. Basic integral equations in fluid mechanics (II).

### Description:

Newton's laws and momentum conservation. Forces over a control volume. Angular momentum equation. Application to turbomachines: characteristic curves.

### Specific objectives:

Identifying forces and torques over a control volume. Determine resulting forces due to flow streams. Estimating torques generated by flow streams.

### Full-or-part-time: 25h

Theory classes: 9h

Laboratory classes: 1h

Self study : 15h

## 6. Pipe flow

### Description:

Developed flows. Laminar and turbulent flow. Main and secondary losses. Flow in non-circular ducts. Hydraulic radius and equivalent diameter. Pipe systems: serial-parallel arrangements. Steady state basic hydraulics, installation resistant curve. Operation point of a pumping installation.

### Specific objectives:

Solving basic steady state hydraulic problems. Developing basic design tasks for fluid distribution installations and determining the operating point in pumps.

### Full-or-part-time: 17h 30m

Theory classes: 6h

Laboratory classes: 1h 30m

Self study : 10h

## GRADING SYSTEM

Mid-term exam (30%); Homework activities (10%); Final exam (40%); Lab Practices (15%); Generic skills (5%). In order to pass the course it is mandatory to attend to all lab practices and deliver the correspondent lab report.

There is a re-evaluation test for this subject.

The student will be able to access the re-assessment test that meets the requirements set by the EEBE in its Assessment and Permanence Regulations.

## EXAMINATION RULES.

The evaluation will be conducted through written test both for the mid-terms and final exam.

There will be 3 homework activities due during the term. These activities will be delivered online through the course intranet.

Practices will be graded based on a pre-test to be presented before the lab practice start, attendance (mandatory) and lab activity developed, together with the preparation and delivery of lab reports.

## BIBLIOGRAPHY

---

### Basic:

- White, Frank M. Mecànica de fluidos [on line]. 6ª ed. Madrid: McGraw-Hill, 2008 [Consultation: 04/06/2020]. Available on: [http://www.ingebook.com/ib/NPcd/IB\\_BooksVis?cod\\_primaria=1000187&codigo\\_libro=4144](http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=4144). ISBN 9788448191283.
- Gerhart, Philip M.; Gross, Richard J.; Hochstein, John I. Fundamentos de mecánica de fluidos. 2ª ed. Argentina: Addison-Wesley Iberoamericana, 1995. ISBN 0201601052.
- Çengel, Yunus A.; Cimbala, John M. Mecánica de fluidos : fundamentos y aplicaciones [on line]. México, D.F: McGraw-Hill, 2018 [Consultation: 04/06/2020]. Available on: [http://www.ingebook.com/ib/NPcd/IB\\_BooksVis?cod\\_primaria=1000187&codigo\\_libro=8102](http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=8102). ISBN 9781456262280.

### Complementary:

- Franzini, Joseph B.; Finnemore, E. John. Mecánica de fluidos con aplicaciones en ingeniería. 9ª ed. Madrid: McGraw-Hill, 1999. ISBN 844812474X.