

## Course guide

### 330125 - EF - Fluid Dynamics Engineering

Last modified: 04/05/2023

**Unit in charge:** Manresa School of Engineering  
**Teaching unit:** 750 - EMIT - Department of Mining, Industrial and ICT Engineering.  
**Degree:** BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Compulsory subject).  
**Academic year:** 2023    **ECTS Credits:** 6.0    **Languages:** Catalan

#### LECTURER

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**Coordinating lecturer:** JORDI VIVES COSTA

**Others:**

#### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

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**Specific:**

1. Understanding the basics of fluid dynamics. Understanding and mastery of the fundamental concepts of hydraulic machines.

**Transversal:**

2. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.  
3. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 3. Communicating clearly and efficiently in oral and written presentations. Adapting to audiences and communication aims by using suitable strategies and means.

#### TEACHING METHODOLOGY

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The course consists of two hours of theory per week in classroom classes (large groups), with lectures with audiovisual support, and two hours per week in small groups dedicated to laboratory practice and problem solving using CFD techniques in a computer classroom.

#### LEARNING OBJECTIVES OF THE SUBJECT

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At the end of the course the student must be able to:

- Know, understand and apply the principles of external flows.
- Understand and apply the principles of internal flows.
- Understand and apply the principles of free surface flows.
- Understand and apply the principles of operation of the different hydraulic machines (pumps and turbines).
- Prepare technical reports and resolution of technical application problems.

#### STUDY LOAD

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Type	Hours	Percentage
Hours large group	30,0	20.00
Hours medium group	30,0	20.00
Self study	90,0	60.00

**Total learning time:** 150 h

## CONTENTS

### Content Title 1: External Flows: Principles of Aerodynamics and Hydrodynamics

**Description:**

Boundary layer theory. Application to external understandable fluid flows. Application to external incompressible fluid flows.

**Specific objectives:**

Know and understand the principles of aerodynamics and hydrodynamics.

**Related activities:**

Continuous assessment test (Activity 1).

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

Theory classes: 6h

Practical classes: 6h

Self study : 18h

### Content Title 2: Internal Flows: Sizing of Piping Systems

**Description:**

Sizing of pipe systems and pipe networks.

**Specific objectives:**

Understanding, analysis and application of the different calculation methodologies to dimension pipe systems and networks.

**Related activities:**

Exercises related to the theory (Activity 2).

Continuous assessment test (Activity 3).

Specific test (Activity 4).

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

Theory classes: 6h

Practical classes: 6h

Self study : 18h

### Content title 3: Flows with free surface: channels

**Description:**

Flows with free surface. Channels. Spillways.

**Specific objectives:**

Understanding, analysis and application of the principles of free surface flows.

**Related activities:**

Exercises related to the theory (Activity 5).

Continuous assessment test (Activity 6).

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

Theory classes: 6h

Practical classes: 6h

Self study : 18h

#### Content title 4: Hydraulic machines: hydraulic pumps and turbines

**Description:**

Principles of operation of rotodynamic and volumetric hydraulic machines. Volumetric and rotodynamic hydraulic pumps. Rotodynamic hydraulic turbines.

**Specific objectives:**

Understanding and application of the principles of operation of volumetric and rotodynamic hydraulic machines. Hydraulic pumps and turbines.

**Related activities:**

Exercises related to the theory (Activity 7).  
Continuous assessment test (Activity 8).  
Final evaluation test (Activity 9).

**Full-or-part-time:** 60h

Theory classes: 12h

Practical classes: 12h

Self study : 36h

## ACTIVITIES

#### TITLE OF ACTIVITY 1: EXERCISES RELATED TO THE THEORY

**Description:**

Carrying out exercises on the corresponding theory topics.

**Specific objectives:**

Development of reasoning techniques and strategies for the analysis and resolution of problems.  
Written communication.  
Autonomous Learning.

**Material:**

Statements and examples on the digital Campus.

**Delivery:**

20% of the final grade.

**Full-or-part-time:** 72h

Practical classes: 30h

Self study: 42h

#### TITLE OF ACTIVITY 2: CFD MODELLING OF EXTERNAL AND INTERNAL FLOW PROBLEMS

**Description:**

Application of CFD techniques in the computer classroom for solving external flow and internal flow problems.

**Specific objectives:**

Experimental learning.

**Material:**

Computers and software, computer room.

**Delivery:**

5 % of the final grade.

**Related competencies :**

. Understanding the basics of fluid dynamics. Understanding and mastery of the fundamental concepts of hydraulic machines.

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

Practical classes: 18h

#### TITLE OF THE ACTIVITY 3: LABORATORY PRACTICE WIND TUNNEL EXPERIMENTATION

**Description:**

Experiment with the aerodynamic forces around bodies of different shapes.

**Specific objectives:**

Experimentation in the wind tunnel of the phenomena typical of Aerodynamics.

**Material:**

Laboratory equipment

**Delivery:**

5 % of the continuous assessment grade

**Full-or-part-time:** 4h

Laboratory classes: 4h

#### TITLE OF ACTIVITY 4: LABORATORY PRACTICE: EXPERIMENTATION OF PRESSURE DROPS IN DUCTS AND FITTINGS

**Description:**

The unit consists of the experimental study of pressure losses in pipes and fittings.

**Specific objectives:**

Experimentally check the influence of diameter, roughness, shape and other characteristics of ducts as they affect head losses.

Experimentally check the pressure drop of fittings such as valves, elbows, etc.

**Material:**

Laboratory equipment

**Delivery:**

5 % of the continuous assessment grade

**Related competencies :**

. Understanding the basics of fluid dynamics. Understanding and mastery of the fundamental concepts of hydraulic machines.

**Full-or-part-time:** 4h

Laboratory classes: 4h

#### TITLE OF ACTIVITY 5: LABORATORY PRACTICAL: FREE SURFACE FLOW EXPERIMENTATION

**Description:**

The practice consists of experimenting with the Chézy equations for free surface flow in open channels and spillways.

**Specific objectives:**

Experimentally verify the laws governing open channel flow

**Material:**

Laboratory Equipment

**Delivery:**

5 % of the continuous assessment grade

**Related competencies :**

. Understanding the basics of fluid dynamics. Understanding and mastery of the fundamental concepts of hydraulic machines.

**Full-or-part-time:** 4h

Laboratory classes: 4h

#### TITLE OF ACTIVITY 6: SPECIFIC TEST PROBLEMS

**Description:**

Taking a written problem-solving test.

**Material:**

Statements problems and calculator.

**Delivery:**

30% of the final grade.

**Full-or-part-time:** 5h

Practical classes: 2h

Self study: 3h

#### TITLE OF ACTIVITY 7: FINAL ASSESSMENT TEST

**Description:**

Carrying out a written problem-solving test for groups of students.

**Specific objectives:**

Upon completion of the activity, the student should be able to:

Understand the fundamentals of indirect thermal machines and direct endothermic machines.

**Material:**

Statements problems and calculator.

**Delivery:**

30% of the final grade.

**Full-or-part-time:** 12h

Practical classes: 2h

Self study: 10h

## GRADING SYSTEM

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Activity 1: 20 % of the final mark  
Activities 2, 3, 4 and 5: 20 % of the final mark.  
Activity 6: 30 % of the final mark  
Activity 7 : 30 % of the final mark

## EXAMINATION RULES.

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Activities not submitted will be considered a "0".

## BIBLIOGRAPHY

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### Basic:

- Çengel, Yunus A.; Cimbala, John M. Mecánica de fluidos: fundamentos y aplicaciones [on line]. 4a ed. México, DF: McGraw-Hill, 2018 [Consultation: 13/11/2020]. 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 9781456260941.
- Gerhart, P.M. ; Gross, R. J. ; Hochstein, J. I. Fundamentos de mecánica de fluidos. 2a ed. Argentina: Adisson Wesley Iberoamericana, 1995. ISBN 0201601052.

### Complementary:

- White, F. M. Mecánica de fluidos [on line]. 6ª. Madrid: McGraw-Hill, 2008 [Consultation: 13/11/2020]. 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 8448140761.
- Agüera, J. Mecánica de fluidos incompresibles y turbomáquinas hidráulicas. 5a ed. Madrid: Ciencia 3, 2002. ISBN 8495391015.

## RESOURCES

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### Other resources:

Non-tabulated resources: Notes on digital campuses  
Audiovisual material: Presentations on the digital campus  
Laboratory equipment