

Course guide

340058 - ENFL-M6O29 - Fluid Engineering

Last modified: 07/02/2025

Unit in charge: Vilanova i la Geltrú School of Engineering
Teaching unit: 729 - MF - Department of Fluid Mechanics.

Degree: BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2024 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: Garcia Gonzalez, Fernando

Others: Cantó Atienza, Gemma
Laparra Vicente, David

PRIOR SKILLS

Integral and differential calculus.
Differential equations.
Previous knowledge of fluid mechanics.

REQUIREMENTS

340025 - Differential equations.
340026 - Advanced calculus.
340039 - Fluid Mechanics.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

1. CE24. Applied basic knowledge of fluid mechanical systems and machines.

Transversal:

2. 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.
3. TEAMWORK - Level 3. Managing and making work groups effective. Resolving possible conflicts, valuing working with others, assessing the effectiveness of a team and presenting the final results.
4. EFFECTIVE USE OF INFORMATION RESOURCES - Level 3. Planning and using the information necessary for an academic assignment (a final thesis, for example) based on a critical appraisal of the information resources used.
5. 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.

TEACHING METHODOLOGY

- Lectures and participatory classes, consisting of explanation and development of the theory and, if necessary in the resolution of problems. The material user will be available to the student in the Digital Campus section of the subject.
- Practical lessons in problem-solving, where it will seek the maximum involvement of students through their direct involvement in solving the problems. Students must solve in class / outside of class, individually or in groups, problems that are assigned. In the Digital Campus section of the subject, the student can look up the list of problems before they are done in class.
- Laboratory practical classes, made directly by students, guided by the teacher, allowing them to directly observe relevant aspects of the theory. The student can look up the explanatory text of the practices to develop in the Digital Campus. The students will give the teacher a copy of the experimental extracted data. Later, students must make a report of the practices carried out. This report will be evaluated and will be delivered before the date set by the teacher.
- Work related to an academic research paper related with the subject content will be requested to the student. The students may work individually or in groups. The presentation of the activity will be in the form of a report and will be evaluated.
- Tutorial classes in group or individual.
- Students will make two exams of all theoretical and practical knowledge developed in the subject.

LEARNING OBJECTIVES OF THE SUBJECT

When the student finishes the subject, he/she has to be capable of:

- Applying knowledge of dimensional analysis and similarity to different problems of fluid mechanics.
- Knowing and calculating the forces over a body submitted to an external flow, in simple cases.
- Describing the principles of fluid machines.
- Analyzing and solving problems relating to facilities and hydraulic machines.
- Using simulation software of hydraulic networks.
- Familiarize with compressible flows.
- Communicating effectively in oral and written presentations.
- Working as a team autonomously and carrying out part of its coordination and / or direction.
- Planning and using the information necessary for an assignment, with a critical analysis of information resources.

STUDY LOAD

Type	Hours	Percentage
Hours small group	7,5	5.00
Self study	90,0	60.00
Hours large group	52,5	35.00

Total learning time: 150 h

CONTENTS

1. DIFFERENTIAL METHOD FOR THE FLOW ANALYSIS

Description:

- 1.1. Preliminary concepts
- 1.2. Kinematics of a fluid particle
- 1.3. Differential Equation of Continuity
- 1.4. Differential Equation of Momentum
 - Non-Viscous Flow (Euler's Equation)
 - Viscous and incompressible flow (Navier-Stokes equation)

Full-or-part-time: 23h 10m

Theory classes: 7h

Self study : 16h 10m

2. DIMENSIONAL ANALYSIS AND SIMILARITY

Description:

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Full-or-part-time: 18h 20m

Theory classes: 6h 20m

Self study : 12h

3. EXTERNAL FLOW: DRAG AND LIFT

Description:

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Full-or-part-time: 22h 20m

Theory classes: 6h 20m

Self study : 16h

4. TURBOMACHINERY

Description:

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Full-or-part-time: 21h 20m

Theory classes: 13h 10m

Self study : 8h 10m

5. TURBOMACHINERY INSTALLATIONS

Description:

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Full-or-part-time: 36h 40m

Theory classes: 13h 40m

Laboratory classes: 5h 20m

Self study : 17h 40m

TOPIC 6. COMPRESSIBLE FLOW

Description:

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Specific objectives:

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Full-or-part-time: 28h 10m

Theory classes: 11h

Laboratory classes: 2h 10m

Self study : 15h

GRADING SYSTEM

The different concepts that make up the continuous assessment are:

- Written individual examinations (85%)
- Laboratory practices and reports (10%)
- Report of a research study (5%)

BIBLIOGRAPHY

Basic:

- Çengel, Yunus A.; Cimbala, John M. Mecánica de fluidos : fundamentos y aplicaciones [on line]. 4a ed. México, D.F: McGraw-Hill, 2018 [Consultation: 20/02/2024]. Available on : https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=8102. ISBN 9781456260941.
- White, Frank M. Mecánica de fluidos [on line]. 6a ed. Madrid [etc.]: McGraw-Hill, 2008 [Consultation: 16/02/2024]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=4144. ISBN 9788448166038.
- Heras, Salvador de las. Mecánica de fluidos en ingeniería [Recurs electrònic] [on line]. Barcelona: Iniciativa Digital Politècnica, 2012 [Consultation: 05/04/2022]. Available on: <https://upcommons.upc.edu/handle/2099.3/36608>. ISBN 9788476539354.
- Potter, Merle C [et al.]. Mecánica de fluidos. 4a ed. México [etc.]: Cengage, 2012. ISBN 9786075194509.

Complementary:

- García Ortega, Justo. Problemas resueltos de máquinas hidráulicas y transitorios hidráulicos. Pamplona: Universidad Pública de Navarra, 2009. ISBN 9788497692472.
- Bergadà Granyó, Josep Maria. Mecánica de fluidos: Breve introducción teórica con problemas resueltos [on line]. Barcelona: Iniciativa Digital Politècnica, 2017 [Consultation: 05/04/2022]. Available on: <https://upcommons.upc.edu/handle/2117/111266>. ISBN 9788498806885.