Universidad del País Vasco — Euskal Herriko Unibertsitatea

COURSE GUIDE 2025/26

Faculty 363 - Faculty of Engineering - Bilbao **Cycle** .

Degree GMECAN30 - Bachelor`s Degree in Mechanical Engineering **Year** Second year

COURSE

27674 - Fluid Mechanics **Credits, ECTS:** 6

COURSE DESCRIPTION

In the course "Fluid Mechanics" the fundamental principles of Physics and Mechanics are applied to fluid matter, that is, to liquids and gases. Students must acquire the necessary knowledge and tools to analyse and understand different type of problems in that field. This way they will be able to understand and support other subjects related to the study of properties and movement of fluids, both, basic subjects and more specific ones.
"Fluid Mechanics" is a compulsory subject, has 6 ECTS credits and it belongs to the second semester of the second year. This subject is studied before the course "Installations and Hydraulic Machines", which is more applied and it is studied in the third year of the Mechanical Engineering degree.
Fluid mechanics. Fluid-mechanical systems and machines. Pipeline conduction.

COMPETENCIES/LEARNING RESULTS FOR THE SUBJECT

To know, understand and apply the basic concepts of fluid mechanics for the professional development of engineering in the field of fluids.
To apply scientific strategies in fluid mechanics: analysis of the situation from a qualitative and quantitative point of view, proposal of hypotheses and suggestion of solutions.
To communicate adequately the knowledge, procedures, results and artfulness related to fluid mechanics, using a specific vocabulary and terminology and the appropriate resources.
To work in groups in an efficient way, integrating skills and knowledge to make good decisions. Adopting a responsible attitude, being organised and willing to learn.
To plan and develop designs and processes in the field of fluid mechanics in accordance with the chosen technology. Analysis and consideration of the social and environmental impact of the technical solutions applied.

Theoretical and Practical Contents

Introduction to fluid mechanics. Introduction to the previous fundamental concepts for the study of fluid mechanics.
Physical properties of fluids. Definitions. Analysis of the fundamental physical properties of fluids.
General laws of fluid statics. Obtaining the fundamental equation of fluid statics from the classification of forces acting on fluids.
Statics of an incompressible fluid in the gravitational field. Hydrostatics. Obtaining the fundamental equation of hydrostatics. Analysis of its consequences and its application to the measurement of pressures.
Statics of fluids in other force fields. Relative equilibrium. Study of the influence of uniform rotation and uniform translation in fluids.
Statics of compressible fluids in the gravitational field. Analysis of pressure variation in compressible fluids.
Forces on surfaces. Calculation of the force made by a fluid, and the point of application of that force, on flat and curved surfaces.
Forces on closed bodies. Calculation of forces made by fluids on closed bodies.
Basis of the movement of fluids. Introduction to the fundamental concepts for studying the movement of fluids.
Mass conservation theory. Continuity equation. Obtaining the mass conservation theory and the continuity equation.
Fundamental equations of fluid dynamics. Presentation of the Euler equations and the Navier-Stokes equations.
Bernoulli's equation. Obtaining of the different forms of the energy equation or Bernoulli's equation and introduction to the concepts of power and efficiency in pumps and turbines.
Applications of Bernoulli's equation. Measurement devices. Application of Bernoulli's equation to determine the speed and flow of a fluid.
Momentum theorem. Obtaining the momentum theorem.
Applications of the momentum theorem. Some technical applications of the theorem.
Dimensional analysis and dynamic similarity.
Introduction to dimensional analysis and dynamic similarity concepts, the Buckingham theorem and its application to the design of hydraulic machines.
Effects of viscosity on flows. Study of external flows, with emphasis on the concepts of boundary layer, resistance and lift.
Study of pressure losses in closed ducts. Introduction to the fundamental equations and diagrams for the calculation of pressure losses in closed ducts.
Permanent flow of fluids in closed ducts. Calculation of ducts. Networks. Calculation of piping systems in series, in parallel and branched, and calculation of meshed networks.
Variable regime in pipes. Calculation of water hammer effect and protections against it.
Permanent flow in open ducts. Channels. Calculation of pressure losses in open ducts.
Hydraulic machines. Fundamental principles. Turbomachinery. Introduction to the fundamental concepts related to hydraulic machines, with emphasis on turbomachines, as well as the phenomenon of cavitation.
Hydraulic turbines. Hydroelectric power plants. Analysis of the different types of hydraulic turbines, their scope, their main elements and their application to hydroelectric plants.

Hydraulic pumps. Description of the different types of hydraulic pumps, their operating principle and their scope. Pumping facilities. Main elements, characteristic curves and pump selection for a pumping facility.

TEACHING METHODS

In the master classes, the topics set out in the course programme will be presented.
The classroom practices will be a complement to the master classes, in which exercises and practical issues will be developed.
The laboratory practices will be a practical complement to the course.
In the event that the sanitary conditions prevent the realization of a teaching activity and / or face-to-face evaluation, a non-face-to-face modality will be activated of which the students will be informed promptly.

TYPES OF TEACHING

Types of teaching	M	S	GA	GL	GO	GCL	TA	TI	GCA
Hours of face-to-face teaching	30		15	15					
Horas de Actividad No Presencial del Alumno/a	45		22,5	22,5					

Legend:

M: Lecture-based	S: Seminar	GA: Applied classroom-based groups
GL: Applied laboratory-based groups	GO: Applied computer-based groups	GCL: Applied clinical-based groups
TA: Workshop	TI: Industrial workshop	GCA: Applied fieldwork groups

Evaluation methods

- End-of-course evaluation

Evaluation tools and percentages of final mark

- Written test, open questions 70%
- Individual assignments 10%
- Individual test on the performance of the lab practices 20%

ORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Only students who can justify any of the reasons numbered in article 43.1.c of the management regulation of the university (UPV/EHU), will be able to ask for a final evaluation (100% of the mark) and will be examined through a theoretical-practical exam.
The rest of the students will be qualified for the different tasks developed throughout the course as follows:
1. Written test where theoretical concepts and problems will be developed: 70%.
2. Individual test on the performance of the lab practices: 20%.
3. Deliverable questions and problems, and continuous assessment tests: 10%.

EXTRAORDINARY EXAMINATION PERIOD: GUIDELINES AND OPTING OUT

Only students who can justify any of the reasons numbered in article 43.1.c of the management regulation of the university (UPV/EHU), will be able to ask for a final evaluation (100% of the mark) and will be examined through a theoretical-practical exam.
The rest of the students will be qualified for the different tasks developed throughout the course as follows:
1. Written test where theoretical concepts and problems will be developed: 70%.
2. Individual test on the performance of the lab practices: 20%.
3. Deliverable questions and problems, and continuous assessment tests: 10%.
Students who do not present themselves for the official call of the course will be classified as "not presented", regardless of their participation in the activities carried out during the course.

MANDATORY MATERIALS

• Course notes.
• Collection of fluid mechanics problems.
• Tables and diagrams of fluid mechanics.
• Notebook of laboratory practices.

BIBLIOGRAPHY

Basic bibliography

- Agüera Soriano, José. "Mecánica de Fluidos incompresibles y Turbomáquinas Hidráulicas" Ed.: Ciencias - 1992.
- Fox R.W. y Mc. Donald A.T. "Introducción a la Mecánica de Fluidos". Ed.: Mc. Graw-Hill - 1989.
- Douglas J. F. "Mecánica de los Fluidos" Volumen I y II. Ed.: Bellisco - 1991.

Detailed bibliography

- White F.M. "Mecánica de fluidos" Ed.: Mc. Graw-Hill 1983.

Journals

Ingeniería del agua.
Tecnología del agua.

Web sites of interest

OBSERVATIONS