

## [GMJ301] FLUID MECHANICS

### GENERAL INFORMATION

<b>Studies</b>	DEGREE IN MECHANICAL ENGINEERING		<b>Subject</b>	FLOW ENGINEERING
<b>Semester</b>	2	<b>Course</b>	2	<b>Mention / Field of specialisation</b>
<b>Character</b>	COMPULSORY		<b>Language</b>	CASTELLANO/EUSKARA
<b>Plan</b>	2022	<b>Modality</b>	Face-to-face	<b>Total hours</b>
<b>Credits</b>	4,5	<b>Hours/week</b>	4	72 class hours + 40.5 non-class hours = <b>112.5 total hours</b>

### PROFESSORS

ERRARTE YARZA, ANE
ALONSO DE MEZQUIA GONZALEZ, DAVID
BIZKARRA LANGARA, KEPA

### REQUIRED PREVIOUS KNOWLEDGE

Subjects	Knowledge
MATHEMATICS I	(No previous knowledge required)
MATHEMATICS II	
PHYSICS I	
MECHANICS	

### LEARNING RESULTS

LEARNING RESULTS	KC	SK	AB	ECTS
<b>GMR209</b> - To know the basic principles of fluid mechanics. Calculation of pipes, channels and fluid systems		x		4,02
<b>G-RTR1</b> - To develop interdisciplinary projects specific to their specialty and of gradual complexity, - becoming aware of respect for human rights and fundamental rights, and analyzing and assessing the impact of the proposed solutions on the SDGs - to acquire and/or apply basic, advanced and /or avant-garde, demonstrating the ability to work in multidisciplinary teams and/or undertake further studies with a high degree of autonomy		x		0,24
<b>G-RTR2</b> - To express information, ideas and the arguments that support them in an orderly, clear and coherent manner, orally and in writing, based on quality information, self-made or obtained from different sources, using inclusive and non-discriminatory language		x		0,24
<b>Total:</b>				<b>4,5</b>

KC: Knowledge or Content / SK: Skills / AB: Abilities

### ENAAE LEARNING RESULTS

- ENA102** - Knowledge and comprehension: Knowledge and comprehension of the engineering disciplines of their speciality, at the level necessary to acquire the rest of the competencies of the degree, including notions of the latest advances.
- ENA103** - Knowledge and comprehension: Awareness of the multidisciplinary context of engineering.
- ENA104** - Analysis in engineering: The ability to analyse complex products, processes and systems in their field of study; choose and apply relevant analytical, calculation and experimental methods in a suitable way; and correctly interpret the results of such analyses.
- ENA105** - Analysis in engineering: The ability to identify, formulate and solve engineering problems in their speciality; choose and apply adequately established analytical, calculation and experimental methods; and acknowledge the importance of social, health and safety, environmental, economic, and industrial restrictions.
- ENA106** - Engineering projects: Ability to project, design and develop complex products (parts, components, finished products, etc.), processes and systems of their speciality, which meet the established requirements, including awareness of the social, health and safety, environmental, economic and industrial aspects, as well as selecting and applying appropriate project methods.
- ENA111** - Practical application of engineering: Understanding of the applicable techniques and methods for analysis, design and research and their limitations in the field of their speciality.
- ENA113** - Practical application of engineering: Knowledge of application of materials, equipment and tools, engineering technology and processes, and their limitations in the field of their speciality.
- ENA118** - Preparation of judgements: Ability to manage complex technical or professional activities or projects of their speciality, taking responsibility for decision making.
- ENA119** - Communication and Teamwork: Ability to effectively communicate information, ideas, problems and solutions in the field of engineering and with society in general.
- ENA120** - Communication and Teamwork: Ability to operate effectively in domestic and international contexts, individually and as a team, and to cooperate with both engineers and people from other disciplines.

### SECONDARY LEARNING RESULTS

**RGM291** [!] *Establecer las responsabilidades de los miembros del equipo utilizando técnicas adecuadas para fomentar la eficiencia del equipo para el desarrollo del proyecto en los plazos establecidos (compartir recursos, aportar ideas, habilidades comunicativas)*

<b>LEARNING ACTIVITIES</b>		<b>CH</b>	<b>NCH</b>	<b>TH</b>
Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams		2 h.	1 h.	3 h.
<b>EVALUATION SYSTEM</b>	<b>W</b>	<b>MAKE-UP MECHANISMS</b>		
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	50%	Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems		
Self-assessment	50%	<b>Comments:</b> Continuous evaluation and feedback of the semi-annual project		
<b>Comments:</b> Students have the responsibility of meeting the tutor to do the tracking of the project and to ensure the achievement of the goals. The average of the marks of the tutor's assessment and the self-assessment carried out by the work team is calculated, using the defined rubrics. Afterwards, the final mark is calculated by multiplying the average mark by a factor calculated on the basis of the co-evaluation among the members of the group.				
<b>CH - Class hours:</b> 2 h.				
<b>NCH - Non-class hours:</b> 1 h.				
<b>TH - Total hours:</b> 3 h.				

**RGM228** [!] *Identificar las propiedades de los fluidos y analizar su comportamiento hidrostático, y conocer los métodos de análisis de la estática de fluidos tanto en el entorno teórico como en el práctico*

<b>LEARNING ACTIVITIES</b>		<b>CH</b>	<b>NCH</b>	<b>TH</b>
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints		2 h.	8 h.	10 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects		14 h.		14 h.
Carrying out exercises and solving problems individually and/or in teams		6 h.	7 h.	13 h.
<b>EVALUATION SYSTEM</b>	<b>W</b>	<b>MAKE-UP MECHANISMS</b>		
Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work, term projects, end of degree project, master's thesis, challenges and problems	20%	Individual written and/or oral tests or individual coding/programming tests		
Individual written and/or oral tests or individual coding/programming tests	70%	<b>Comments:</b> Continuous evaluation. FEEDBACK received from the tutor in the semester project follow-up meetings.		
Observation (technical capacity, attitude and participation)	10%			
<b>Comments:</b> Students have the responsibility of meeting the experts to do the tracking of the project and to ensure the achievement of the goals.				
<b>CH - Class hours:</b> 22 h.				
<b>NCH - Non-class hours:</b> 15 h.				
<b>TH - Total hours:</b> 37 h.				

**RGM290** [!] *Proponer los objetivos y la planificación de un proyecto que le permita adquirir y/o reforzar los conocimientos de tecnologías propias de su especialidad,- que en ocasiones llegan a la vanguardia del conocimiento- y definir una estrategia de aprendiz*

<b>LEARNING ACTIVITIES</b>		<b>CH</b>	<b>NCH</b>	<b>TH</b>
Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams		2 h.	1 h.	3 h.
<b>EVALUATION SYSTEM</b>	<b>W</b>	<b>MAKE-UP MECHANISMS</b>		
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	100%	Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems		
<b>Comments:</b> Students have the responsibility of meeting the tutor				
<b>Comments:</b> Continuous evaluation. FEEDBACK received from the				

to do the tracking of the project and to ensure the achievement of the goals. tutor in the project follow-up meetings

**CH - Class hours:** 2 h.  
**NCH - Non-class hours:** 1 h.  
**TH - Total hours:** 3 h.

**RGM293** [!] *Redacta y estructura correctamente la memoria del proyecto, haciendo un uso correcto, inclusivo y no discriminatorio del lenguaje. Para ello, busca y hace uso de las fuentes de información adecuadas.*

**LEARNING ACTIVITIES**

	<i>CH</i>	<i>NCH</i>	<i>TH</i>
Development and writing of records, reports, presentations, audiovisual material, etc. on projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams	2 h.	1 h.	3 h.

**EVALUATION SYSTEM**

	<i>W</i>
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	100%

**Comments:** Students have the responsibility of meeting the tutor to do the tracking of the project and to ensure the achievement of the goals.

**MAKE-UP MECHANISMS**

Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems

**Comments:** Continuous evaluation. FEEDBACK received from the tutor in the project follow-up meetings.

**CH - Class hours:** 2 h.  
**NCH - Non-class hours:** 1 h.  
**TH - Total hours:** 3 h.

**RGM294** [!] *Realiza una presentación oral del proyecto con argumentos elaborados por sí mismos y haciendo un uso correcto, inclusivo y no discriminatorio del lenguaje.*

**LEARNING ACTIVITIES**

	<i>CH</i>	<i>NCH</i>	<i>TH</i>
Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams	2 h.	1 h.	3 h.

**EVALUATION SYSTEM**

	<i>W</i>
Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work, term projects, end of degree project, master's thesis, challenges and problems	100%

**Comments:** Students have the responsibility of meeting the tutor to do the tracking of the project and to ensure the achievement of the goals.

**MAKE-UP MECHANISMS**

Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work, term projects, end of degree project, master's thesis, challenges and problems

**Comments:** Continuous evaluation. FEEDBACK received from the tutor in the project follow-up meetings.

**CH - Class hours:** 2 h.  
**NCH - Non-class hours:** 1 h.  
**TH - Total hours:** 3 h.

**RGM229** [!] *Analizar el comportamiento hidrodinámico de los fluidos viscosos utilizando métodos analíticos, análisis adimensional, teoría de modelos y aplicarlos a diferentes entornos teóricos y prácticos*

**LEARNING ACTIVITIES**

	<i>CH</i>	<i>NCH</i>	<i>TH</i>
Development and writing of records, reports, presentations, audiovisual material, etc. on projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams	9 h.	9 h.	18 h.

Conducting tests, giving presentations, presenting defences, taking examinations and/or doing	2 h.	1,5 h.	3,5 h.
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checkpoints			
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects		24 h.	24 h.
Carrying out exercises and solving problems individually and/or in teams		7 h.	11 h. 18 h.
<b>EVALUATION SYSTEM</b>	<b>W</b>	<b>MAKE-UP MECHANISMS</b>	
Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work, term projects, end of degree project, master's thesis, challenges and problems	70%	Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	
Individual written and/or oral tests or individual coding/programming tests	20%	<b>Comments:</b> The evaluation of the semester project will be continuous and will be based on the meetings of the team with the tutor and the experts. One week before the final delivery of the report, the work as a whole will be analysed, the necessary improvements will be defined and communicated to the team.	
Observation (technical capacity, attitude and participation)	10%	Improvements must be made before the delivery of the final version of the report.	
<b>Comments:</b> Students have the responsibility of meeting the tutor to do the tracking of the project and to ensure the achievement of the goals.			
<b>CH - Class hours:</b> 42 h.			
<b>NCH - Non-class hours:</b> 21,5 h.			
<b>TH - Total hours:</b> 63,5 h.			

## CONTENTS

TOPIC I: INTRODUCTION TO FLUID MECHANICS

TOPIC II: PHYSICAL PROPERTIES OF FLUIDS

TOPIC III: HYDROSTATICS

TOPIC IV: HYDRODYNAMICS

TOPIC V: DIMENSIONLESS METHOD AND SIMILARITY

TOPIC VI: TURBOMACHINES

## LEARNING RESOURCES AND BIBLIOGRAPHY

Learning resources	Bibliography
Student book	M.White, Frank. Mecanica de Fluidos, 5ª Ed., Mc Graw Hill, 2004; 84-481-4076-1
Slides of the subject	Çengel, Yunus A. Fluid mechanics : fundamentals and applications, 1st ed, McGraw-Hill ISBN 0&#8211;07&#8211;247236&#8211;7
Moodle Platform	Fluido en fluxua eta bero-trukea ingeniari-tzan / Octave Lenvenspiel
Video projections	Fluidos, Bombas e instalaciones hidráulicas; S. de las Heras, UPCGrua, 2011.