

## [GJM201] THERMAL AND FLUID ENGINEERING

### GENERAL INFORMATION

<b>Studies</b>	DEGREE IN MECHATRONICS ENGINEERING		<b>Subject</b>	?
<b>Semester</b>	2	<b>Course</b>	3	<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>	3	<b>Hours/week</b>	2.5	45 class hours + 30 non-class hours = <b>75 total hours</b>

### PROFESSORS

BIZKARRA LANGARA, KEPA

### REQUIRED PREVIOUS KNOWLEDGE

Subjects	Knowledge
PHYSICS I	(No previous knowledge required)
PHYSICS II	
CALCULUS I	
MATHEMATICS APPLIED TO ENGINEERING	

### LEARNING RESULTS

LEARNING RESULTS	KC	SK	AB	ECTS
<b>GJR306</b> - To know and apply the basic principles of fluid mechanics and thermodynamics applied to the resolution of engineering problems			x	2,6
<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		0,16
<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>3</b>

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

### SECONDARY LEARNING RESULTS

**RGJ390** [!] *Definir y gestionar los objetivos y la planificación de un proyecto que le permita adquirir y/o reforzar los conocimientos de tecnologías específicas de su especialidad,- que en ocasiones llegan a la vanguardia del conocimiento- y definir una estrate*

#### LEARNING ACTIVITIES

Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams

CH	NCH	TH
1 h.	1 h.	2 h.

#### EVALUATION SYSTEM

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

W  
100%

#### MAKE-UP MECHANISMS

(No mechanisms)  
**Comments:** Continuous assessment. Retake is not foreseen.

**CH - Class hours:** 1 h.

**NCH - Non-class hours:** 1 h.

**TH - Total hours:** 2 h.

**RGJ391** [!] *Coordinar el equipo de trabajo, estimulando la cohesión y buen clima para lograr la integración de todas las personas y su contribución para alcanzar un rendimiento apropiado, tanto a nivel individual como grupal, para el desarrollo del proyecto en*

#### LEARNING ACTIVITIES

Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams

CH	NCH	TH
1 h.	1 h.	2 h.

EVALUATION SYSTEM	W	MAKE-UP MECHANISMS
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	100%	(No mechanisms) <b>Comments:</b> Continuous assessment. Retake is not foreseen.
<b>CH - Class hours:</b> 1 h. <b>NCH - Non-class hours:</b> 1 h. <b>TH - Total hours:</b> 2 h.		

**RGJ393** [!] *Elabora la memoria del proyecto, aportando argumentos elaborados y haciendo un uso correcto, inclusivo y no discriminatorio del lenguaje.*

LEARNING ACTIVITIES	CH	NCH	TH
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	1 h.	2 h.	3 h.
EVALUATION SYSTEM	W	MAKE-UP MECHANISMS	
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	100%	(No mechanisms) <b>Comments:</b> Revision and correction of the written report of the semester project	
<b>CH - Class hours:</b> 1 h. <b>NCH - Non-class hours:</b> 2 h. <b>TH - Total hours:</b> 3 h.			

**RGJ394** [!] *Realiza una presentación oral del proyecto, justificando las soluciones propuestas con argumentos elaborados y precisos, y haciendo un uso correcto, inclusivo y no discriminatorio del lenguaje.*

LEARNING ACTIVITIES	CH	NCH	TH
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	W	MAKE-UP MECHANISMS	
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	100%	(No mechanisms) <b>Comments:</b> Continuous assessment. Retake is not foreseen.	
<b>CH - Class hours:</b> 2 h. <b>NCH - Non-class hours:</b> 1 h. <b>TH - Total hours:</b> 3 h.			

**RGJ3316** [!] *Identificar las propiedades de los fluidos, su comportamiento hidrostático e hidrodinámico y aplicar los conceptos básicos y ecuaciones principales para analizar los sistemas fluidicos*

LEARNING ACTIVITIES	CH	NCH	TH
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	4 h.	3 h.	7 h.
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	2,5 h.	3 h.	5,5 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	11 h.	4 h.	15 h.

EVALUATION SYSTEM	W	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	15%	Individual written and/or oral tests or individual coding/programming tests
Individual written and/or oral tests or individual coding/programming tests	85%	<b>Comments:</b> If a retake exam is needed, the final mark will be obtained 25% first mark 75% second one

**CH - Class hours:** 17,5 h.  
**NCH - Non-class hours:** 10 h.  
**TH - Total hours:** 27,5 h.

**RGJ3317** [!] *Examinar la transferencia de calor por conveccion, conduccion y radiación ademas de dimensionar los componentes de la transferencia de calor entre fluidos*

LEARNING ACTIVITIES	CH	NCH	TH
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	3,5 h.	3,5 h.	7 h.
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	2,5 h.	3 h.	5,5 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	10 h.	5 h.	15 h.

EVALUATION SYSTEM	W	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	15%	Individual written and/or oral tests or individual coding/programming tests
Individual written and/or oral tests or individual coding/programming tests	85%	<b>Comments:</b> If a retake exam is needed, the final mark will be obtained 25% first mark 75% second one

**CH - Class hours:** 16 h.  
**NCH - Non-class hours:** 11,5 h.  
**TH - Total hours:** 27,5 h.

**RGJ3318** [!] *Diseñar y dimensionar sistemas fluidicos y sistemas de transferencia de calor*

LEARNING ACTIVITIES	CH	NCH	TH
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	1,5 h.	1 h.	2,5 h.
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	1 h.	1,5 h.	2,5 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	4 h.	1 h.	5 h.

EVALUATION SYSTEM	W	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	15%	Individual written and/or oral tests or individual coding/programming tests
Individual written and/or oral tests or individual coding/programming tests	85%	<b>Comments:</b> If a retake exam is needed, the final mark will be obtained 25% first mark 75% second one

**CH - Class hours:** 6,5 h.  
**NCH - Non-class hours:** 3,5 h.  
**TH - Total hours:** 10 h.

## CONTENTS

- 1.-FLUID PROPERTIES
  - 1.1.- Basics concepts and definition
  - 1.2.- Properties of the fluid
- 2.- HYDROSTATIC
  - 2.1.- Basics concepts and definition
  - 2.2.- Pressure measurements
  - 2.3.- Pascal's law
  - 2.4.- Static forces acting on submerged surface
- 3.- HYDRODYNAMICS
  - 3.1.- Basic concepts
  - 3.2.- Conservation of Mass
  - 3.3.- Conservation of Momentum
  - 3.4.- Conservation of Energy (Bernoulli's principle)
- 4.- VISCOUS FLOW
  - 4.1.- Load loss
  - 4.2.- Reynold's experiment
  - 4.3.- Poiseuille's equation
  - 4.4.- Darcy-Weisbach equation. General concepts
  - 4.5.- Localized load loss
  - 4.6.- Union of pipes
- 5.-HEAT TRANSFER MECHANISMS
  - 5.1.-Conduction
  - 5.2.-Convection
  - 5.3.-Radiation
- 6.-FINS (extended surfaces)
- 7.-CONVECTION IN PLATES AND PIPES
  - 7.1-Determination of the film coefficient
- 8.-HEAT EXCHANGERS DESIGN

## LEARNING RESOURCES AND BIBLIOGRAPHY

Learning resources	Bibliography
Moodle Platform Subject notes	Jariakin konprimaезinen mekanika eta turbomakina hidraulikoak; J. Agüera Soriano; EHU/UPV-ko argitalpen zerbitzua, Bilbo, 1994. Fluidoен fluxua eta bero-trukea ingeniari-tzan, O. Levenspiel; EHU/UPV-ko argitalpen zerbitzua, Bilbo, 2009. Fisika zientzialari eta ingeniari-entzat, P. M. Fishbane, S. Gasiorowicz, S. T. Thornton, EHU-ko argitalpen zerbitzua, 2008. Fisika Orokorra, UEU-ko Fisika saila; Udako Euskal Unibertsitatea, Bilbo, 1992 Forma eta fluxua. Arrastearen fluido-dinamika, A. H. Shapiro, Itzul.:

J. R. Etxebarria, J. M. Igartua, J. I. Urresti; Udako Euskal Unibertsitatea, Bilbo, 2000.

Ingeniaritza fluidomekanikoa: ariketa-bilduma, X. Almandoz, B. Mongelos, I. Pellejero, F. Santos; Elhuyar; Usurbil; 1998.

Fisika orokorra: ariketak, UEU-ko Fisika saila; Udako Euskal Unibertsitatea, 1989.

2500 Solved Problems in Fluid Mechanics and Hydraulics, J. B. Evett, Cheng Liu., Mc Graw- Hill.

A heat transfer textbook, John H. Lienhard IV and John H. Lienhard V, third edition, Cambridge MA, Phlogiston Press, 2004.

Heat Transfer A Practical Approach, Cengel, Yunus A and Cengel, Yunus, McGraw Hill Professional, 2003.

Fundamentals of heat and mass transfer, Incropera Frank, Dewitt David, Bergman Theodore, Lavine Adrienne, sixth edition, 2011

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