

[GDN302] THERMAL AND FLUID ENGINEERING

GENERAL INFORMATION

Studies	DEGREE IN INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING		Subject	?	
Semester	1	Course	3	Mention / Field of specialisation	
Character	COMPULSORY				
Plan	2022	Modality	Face-to-face	Language	CASTELLANO/EUSKARA
Credits	4,5	Hours/week	3.33	Total hours	60 class hours + 52.5 non-class hours = 112.5 total hours

PROFESSORS

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REQUIRED PREVIOUS KNOWLEDGE

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

LEARNING RESULTS

LEARNING RESULTS	KC	SK	AB	ECTS
GDR304 - To know the basic principles of thermodynamics and fluid mechanics to apply them in product design		x		3,78
G-RTR1 - 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		0,4
G-RTR2 - 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		0,32
Total:				4,5

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

ENAE LEARNING RESULTS

ENAE LEARNING RESULTS	ECTS
ENAE02 - Knowledge and understanding: A systematic understanding of the key aspects and concepts of their branch of engineering.	1,12
ENAE06 - Analysis in engineering: Ability to apply their knowledge and understanding in analysing product, process and method engineering.	0,92
ENAE08 - Engineering projects: Ability to apply their knowledge in the development and completion of projects which meet specific requirements.	0,4
ENAE10 - Research & innovation: Ability to perform bibliographic searches, to use databases and other sources of information.	0,24
ENAE14 - Practical application of engineering: Ability to combine theory and practice in order to solve engineering problems.	0,2
ENAE18 - Transversal competences: To use different methods to communicate effectively with the engineering community and society in general.	1,62
Total:	4,5

SECONDARY LEARNING RESULTS

[RGD390] [!] 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

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 h.	1 h.	4 h.

EVALUATION SYSTEM

Presentation and defence of exercises, case studies, computer practical work, simulation practical work,	<i>W</i> 100%
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MAKE-UP MECHANISMS

Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work,

laboratory practical work, term projects, end of degree project, master's thesis, challenges and problems

term projects, end of degree project, master's thesis, challenges and problems

CH - Class hours: 3 h.
NCH - Non-class hours: 1 h.
TH - Total hours: 4 h.

RGD391 [!] *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

	<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

W

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%

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

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

RGD392 [!] *Identificar y argumentar de forma precisa los ODS en los que incide el proyecto realizado, aportando posibles acciones para la mejora.*

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

W

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%

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

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

RGD393 [!] *Elabora la memoria del proyecto, aportando argumentos elaborados y haciendo un uso correcto, inclusivo y no discriminatorio del lenguaje.*

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	3 h.	1 h.	4 h.

EVALUATION SYSTEM

W

Presentation and defence of exercises, case studies, computer practical work, simulation practical work,

100%

MAKE-UP MECHANISMS

Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work,

laboratory practical work, term projects, end of degree project, master's thesis, challenges and problems

term projects, end of degree project, master's thesis, challenges and problems

CH - Class hours: 3 h.
NCH - Non-class hours: 1 h.
TH - Total hours: 4 h.

RGD394 [!] *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

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

CH	NCH	TH
3 h.	1 h.	4 h.

EVALUATION SYSTEM

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

W

100%

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

CH - Class hours: 3 h.
NCH - Non-class hours: 1 h.
TH - Total hours: 4 h.

RGD306 [!] *Conoce los métodos de análisis y leyes fundamentales que gobiernan el comportamiento de los fluidos en estado estático y dinámico aplicables al diseño de productos.*

LEARNING ACTIVITIES

Personal study and flexible development of concepts and subjects using active dynamics, to foster more meaningful learning
 Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects
 Carrying out exercises and solving problems individually and/or in teams

CH	NCH	TH
5 h.	15 h.	20 h.
15 h.	5 h.	20 h.
4 h.	3,25 h.	7,25 h.

EVALUATION SYSTEM

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
 Individual written and/or oral tests or individual coding/programming tests
 Observation (technical capacity, attitude and participation)

W

15%
 75%
 10%

MAKE-UP MECHANISMS

Individual written and/or oral tests or individual coding/programming tests

CH - Class hours: 24 h.
NCH - Non-class hours: 23,25 h.
TH - Total hours: 47,25 h.

RGD307 [!] *Conoce los mecanismos de la transferencia de calor además de diseñar componentes para la transferencia de calor entre fluidos.*

LEARNING ACTIVITIES

Personal study and flexible development of concepts and subjects using active dynamics, to foster more meaningful learning

CH	NCH	TH
5 h.	15 h.	20 h.

Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	15 h.	5 h.	20 h.
Carrying out exercises and solving problems individually and/or in teams	3 h.	4,25 h.	7,25 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	75%		
Observation (technical capacity, attitude and participation)	10%		
CH - Class hours: 23 h.			
NCH - Non-class hours: 24,25 h.			
TH - Total hours: 47,25 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.-HEAT EXCHANGERS DESIGN

LEARNING RESOURCES AND BIBLIOGRAPHY

Learning resources	Bibliography
(No resources)	<p>Jariakin konprimaezinen mekanika eta turbomakina hidraulikoak; J. Agüera Soriano; EHU/UPV-ko argitalpen zerbitzua, Bilbo, 1994.</p> <p>Fluidoen fluxua eta bero-trukea ingeniarietan, O. Levenspiel; EHU/UPV-ko argitalpen zerbitzua, Bilbo, 2009.</p> <p>Fisika zientzialari eta ingeniarietan, P. M. Fishbane, S. Gasiorowicz, S. T. Thornton, EHU-ko argitalpen zerbitzua, 2008.</p> <p>Fisika Orokorra, UEU-ko Fisika saila; Udako Euskal Unibertsitatea, Bilbo, 1992.</p> <p>Forma eta fluxua. Arrastearen fluido-dinamika, A. H. Shapiro, Itzul.: J. R. Etxebarria, J. M. Igartua, J. I. Urresti; Udako Euskal Unibertsitatea, Bilbo, 2000.</p> <p>Ingeniaritza fluidomekanikoa: ariketa-bilduma, X. Almandoz, B. Mongelos, I. Pellejero, F. Santos; Elhuyar; Usurbil; 1998.</p>

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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