[MHK202] THERMAL AND FLUIDS ENGINEERING

GENERAL INFORMATION

Studies	UNIVERSITY MASTER IN INDUSTRIAL ENGINEERING			**Subject**	?
Semester	2	**Course**	1	**Mention / Field of specialisation**	
Character	COMPULSORY				
Plan	2022	**Modality**	Face-to-face	**Language**	CASTELLANO/EUSKARA
Credits	5	**Hours/week**	3.33	**Total hours**	60 class hours + 65 non-class hours = **125 total hours**

PROFESSORS

MARTINEZ AGUIRRE, MANEX
ZARKETA ASTIGARRAGA, ANDER
BIZKARRA LANGARA, KEPA

REQUIRED PREVIOUS KNOWLEDGE

Subjects	Knowledge
Thermodynamics	*(No previous knowledge required)*
Fluid dynamics	
Heat transfer	
Mechanical physics	

LEARNING RESULTS

LEARNING RESULTS	KC	SK	AB	ECTS
MHRA01 - To know, analyze and design electrical energy generation, transportation and distribution systems		x		0,2
MHRA05 - Tod design and analyze thermal machines and engines, hydraulic machines and industrial heat and cold installations		x		3,88
MHRA06 - To understand, analyze, exploit and manage the different energy sources		x		0,24
MHRA27 - To demonstrate the ability to integrate knowledge and face the complexity of formulating judgments based on information that, being incomplete or limited, includes reflections on the social, health and safety, environmental, economic and industrial implications and responsibilities		x		0,2
MHRA28 - To communicate your conclusions and the knowledge and ultimate reasons that support them to specialized and non-specialized audiences in a clear and unambiguous way		x		0,08
MHRA30 - To work with people, involving and directing them in a dynamic aimed at a common objective that includes reflection on their ethical and social responsibility, with a global vision of the work to be carried out and the characteristics that it requires (quality, deadlines,...), assuming responsibility for the decisions made		x		0,08
MHR125 - To possess and understand knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context		x		0,16
MHR126 - To apply the knowledge acquired and your problem-solving skills in new, little-known or changing environments within broader (or multidisciplinary) contexts related to your area of ??study		x		0,08
MHR129 - To possess the learning skills that allow them to continue studying in a way that will be largely self-directed or autonomous		x		0,08
			Total:	5

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

ENAEE LEARNING RESULTS	ECTS
ENA123 - Knowledge and comprehension: Deep knowledge and comprehension of mathematics and other basic sciences inherent in their engineering speciality, allowing them to achieve the other competencies of the degree.	0,5
ENA124 - Knowledge and comprehension: Deep knowledge and comprehension of the engineering disciplines of their speciality, at the level necessary to acquire the rest of the competencies of the degree.	0,5
ENA126 - Knowledge and comprehension: Critical knowledge of the broad multidisciplinary context of engineering and the interrelations existing between the knowledge of the different fields.	0,5
ENA127 - Analysis in engineering: Ability to analyse new and complex engineering products, processes and systems within a broader multidisciplinary context; select and apply the most appropriate analysis, calculation and experimental methods already established, as well as innovative methods; and critically interpret the results of such analyses.	0,6
ENA129 - Analysis in engineering: Ability to identify, formulate and solve engineering problems defined incompletely, and/or with conflicts, which accept different valid solutions and require considering knowledge beyond those of their discipline and take into account the social, health and security, environmental, economic and industrial implications; to select and apply the most appropriate methods of analysis, calculation and experimental, as well as the most innovative methods for solving problems.	0,5
ENA138 - Practical application of engineering: Complete knowledge of the applicable techniques and methods of analysis, project and research, as well as their limitations.	0,5
ENA144 - Preparation of judgements: Ability to integrate knowledge and handle complex concepts and formulate judgements with limited or incomplete information, including reflection on ethical and social responsibility related to the application of their knowledge and opinion.	0,8
ENA146 - Communication and Teamwork: Ability to employ different methods to communicate their conclusions, clearly and	0,6

unambiguously, and the knowledge and logical foundations that support them, to audiences specialised and not specialised in the issue, in domestic and international contexts.

ENA147 - Communication and Teamwork: Ability to operate effectively in domestic contexts as a member or leader of a team, which may be composed of people of different disciplines and levels, and who can use virtual communication tools. 0,5

Total: 5

SECONDARY LEARNING RESULTS

RMH131 **[!]** ***Identifica y evalúa los parámetros de funcionamiento de equipos de generación y consumo energético***

LEARNING ACTIVITIES	CH	NCH	TH
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	2 h.	10 h.	12 h.
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	2 h.	19 h.	21 h.

EVALUATION SYSTEM	W
Individual written and/or oral tests or individual coding/programming tests	100%

Comments: All activities (control points, individual and group assignments, etc...) must have a minimum mark (5 minimum) and there will be an opportunity to retake every activity. In case of retake of the control point, the final mark will be the mark of the retake.

MAKE-UP MECHANISMS

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

Comments: Assignments: - Minimum pass mark: 5 - There will be the option of a make-up. Maximum mark after recovery: 5 - Minimum mark Minimum mark to average between exam and work: 5 In order to pass the learning outcomes, the minimum marks must be achieved in the control points and work. If this minimum mark is not achieved in one of them, the mark will be the one corresponding to this minimum, and no average will be made with the multi-disciplinary work.

CH - Class hours: 28 h.
NCH - Non-class hours: 29 h.
TH - Total hours: 57 h.

RMH132 **[!]** ***Analiza e interpreta sistemas térmicos***

LEARNING ACTIVITIES	CH	NCH	TH
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	2 h.	10 h.	12 h.
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	4 h.	13 h.	17 h.

EVALUATION SYSTEM	W
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	100%

Comments: All activities (control points, individual and group assignments, etc...) must have a minimum mark (5 minimum) and there will be an opportunity to retake every activity. In case of retake of the control point, the final mark will be the mark of the retake.

MAKE-UP MECHANISMS

(No mechanisms)

Comments: Assignments: - Minimum pass mark: 5 - There will be the option of a make-up. Maximum mark after recovery: 5 - Minimum mark Minimum mark to average between exam and work: 5 In order to pass the learning outcomes, the minimum marks must be achieved in the control points and work. If this minimum mark is not achieved in one of them, the mark will be the one corresponding to this minimum, and no average will be made with the multi-disciplinary work.

CH - Class hours: 30 h.
NCH - Non-class hours: 23 h.
TH - Total hours: 53 h.

RMH133 **[!]** ***Dimensiona elementos estructurales sometidos a cargas térmicas y fluídicas***

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.	13 h.	15 h.

EVALUATION SYSTEM	W
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	40%
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	60%

Comments: In addition to other assignments, the evaluation of the multidisciplinary projects consists of an individual defence that must be passed with a minimum mark of 5. Only if this mark is 5 or more, the average will be made with the other parts to calculate the final mark.

MAKE-UP MECHANISMS

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

Comments: Assignments: - Minimum pass mark: 5 - There will be the option of a make-up. Maximum mark after recovery: 5 - Minimum mark Minimum mark to average between exam and work: 5 In order to pass the learning outcomes, the minimum marks must be achieved in the control points and work. If this minimum mark is not achieved in one of them, the mark will be the one corresponding to this minimum, and no average will be made with the multi-disciplinary work.

CH - Class hours: 2 h.
NCH - Non-class hours: 13 h.
TH - Total hours: 15 h.

CONTENTS

1. Fundamentals of thermodynamics. Properties of fluids, behaviour of ideal gases, transformations, Laws of Thermodynamics: conservation of energy and entropy generation. Combination of laws: exergy.

2. Turbomachines and their components. Nozzles.

3. Internal Combustion Reciprocating Engines.

4. Steam power cycles, refrigeration cycles and heat pumps.

5. Fundamentals of combustion.

LEARNING RESOURCES AND BIBLIOGRAPHY

Learning resources

Moodle Platform
Slides of the subject

Bibliography

Çengel, Y. A., Boles, M. A. and Cázares, G. N. Termodinámica. McGraw-Hill. 2006.

Moran, M.J. and Shapiro, H.N. Fundamentals of Engineering Thermodynamics. John Wiley & Sons. 2010.

Muñoz, M. and Payri, F. Motores de combustión interna alternativos. Editorial Universitat Politècnica de València, 2011.

Vivier, . Turbinas de vapor y de gas. Urmo, 1968.

Cumpsty, N. and Heyes, A. Jet propulsion. Cambridge University Press, 2015.

Incropera, F. P., DeWitt F. P. and Bergman T. L. Fundamentos de Transferência de Calor E de Massa . Grupo Gen-LTC, 2000.