



## IDENTIFYING DATA

### Thermal Technology I

Subject	Thermal Technology I			
Code	V04M141V01112			
Study programme	(*)Máster Universitario en Enxeñaría Industrial			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	1st	1st
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Cerdeira Pérez, Fernando			
Lecturers	Cerdeira Pérez, Fernando			
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General description	In this subject pretends that the student purchase the essential knowledges that allow him comprise the operation of the thermal machines and the processes that take place in his interior, as well as that know the types of machines and installations more important and his components. His knowledge results basic for the analysis of the operation, design and construction of the thermal machines and of the thermal teams associated to the same, and in general the industrial applications of the thermal engineering.			
	English Friendly subject: International students may request from the teachers: a) resources and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

## Training and Learning Results

Code	
A1	Knowledge and understanding that provide a basis or opportunity for originality in developing and / or applying ideas, often in a research context.
A2	That the students can apply their knowledge and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study.
C7	CET7. Apply their knowledge and solve problems in new or unfamiliar environments within broader contexts and multidisciplinary environments.
C17	CTI6. Knowledge and capabilities to understand, analyze, operate and manage the different sources of energy.

## Expected results from this subject

Expected results from this subject	Training and Learning Results
(*)	A1 A2 C7 C17

## Contents

Topic	
Installations with cycle of steam and of gas.	Introduction to the thermal head offices. Main components. Cycles Rankine, Brayton and combined. Thermal balance. Thermal performance.

Study of the humid air.	Introduction. Variables psychrometrics. Diagrams psychrometrics. Cooling towers.
Industrial fuels and his combustion.	Classification of the fuels. Properties of the fuels. Types of combustion.
Burners and boilers.	Definitions. Types of burners. Classification of boilers. Energetic balance. Performance.
Processes of spill.	Nozzles and diffusers.
Machines and thermal engines.	Generalities and fundamental processes. Classification. Components of the engines. Thermodynamic analysis. Characteristic parameters.
Pumping of heat.	Definitions. Cycle of Carnot reverse. Cycle of mechanical compression. Bomb of heat. Refrigeration by absorption.
Application of the renewable energies.	Thermal solar energy. Geothermal energy. Biomass and residual fuels.
Heat exchangers.	Introduction. Types of exchangers. Analysis of exchangers of heat. - Method DTLM - Method NTU
-- Laboratory practices.	- Study of the flame propagation. - Higrometric study of the air. - Study of the heat exchangers. - Study of the engines of 2T. - Study of the engines of 4T. - Study of heat pump. - Energetic balance of a boiler. - Visit to a boilers room.

## Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	18	18	36
Problem solving	13.5	24.5	38
Practices through ICT	4	4	8
Laboratory practical	14	5	19
Autonomous problem solving	0	20	20
Problem and/or exercise solving	2	0	2
Essay	0	15	15
Objective questions exam	1	5	6
Objective questions exam	1	5	6

\*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

## Methodologies

	Description
Lecturing	Exhibition by part of the professor of the contents of the matter object of study.
Problem solving	Resolution of problems and/or exercises related with the subject that the student will make in classroom and/or laboratory. They will resolve problems of character "type" and/or practical examples.
Practices through ICT	Simulation of processes related with the content of the matter using specific software.
Laboratory practical	Experimentation of real processes in laboratory that complement the contents of the matter.
Autonomous problem solving	Resolution of problems and/or exercises related with the subject that the student will make out of the classroom.

## Personalized assistance

## Methodologies Description

Lecturing	The doubts will resolve in the schedule of tutorials of face-to-face form or through the remote campus, if it proceeds.
Problem solving	The doubts will resolve in the schedule of tutorials of face-to-face form or through the remote campus, if it proceeds.

## Assessment

	Description	Qualification	Training and Learning Results	
Lecturing	Final exam (written, oral,...) of theory. Short answer questions or type test.	15	A1 A2	C7 C17
Problem and/or exercise solving	Final exam (written, oral,...) of problems or practical cases.	25	A1 A2	C7 C17
Essay	Individual works and/or in consistent group in the utilisation of specific software, resolution of practical cases,... related with the contents of the matter.	20	A1 A2	C7 C17
Objective questions exam	Objective proof (1) consisting of short questions or multiple choice to know the progressive evolution of the students during the development of the matter.	20	A1 A2	C7 C17
Objective questions exam	Objective proof (2) consisting of short questions or multiple choice to know the progressive evolution of the students during the development of the matter.	20	A1 A2	C7 C17

## Other comments on the Evaluation

The final examination will be composed by a theory part (15%) and a problem part (25%) and it will be mandatory to obtain a minimum mark of 3,5 out of 10 between both tests. The continuous evaluation (EC) will be evaluated by the work (W) and by 2 objective tests (PO); those who have officially renounced the EC will have had to take a specific questionnaire (CE) at the first opportunity of the course announcement.

In the second opportunity (July call), the students that have made the EC will be able to choose between keeping the EC mark or make the SQ of the second opportunity.

The End of Degree call will be fully evaluated by means of an exam (100%), that is, the EC of the previous course will not be taken into account.

A numerical rating system of 0 to 10 points will be used according to current legislation (RD 1125/2003, September 5, BOE September 18).

It is expected an adequate ethical behaviour of the student. In case of detecting unethical behaviour (copying, plagiarism, unauthorized use of electronic devices, etc.) shall be deemed that the student does not meet the requirements for passing the subject. In this case, the overall rating in the current academic year will be Fail (0.0).

The use of any electronic device for the assessment tests is not allowed unless explicitly authorized. The fact of introducing unauthorized electronic device in the examination room will be considered reason for not passing the subject in the current academic year and will hold overall rating (0.0).

## Sources of information

### Basic Bibliography

Agüera Soriano, José, **Termodinámica lógica y motores térmicos**, Ciencia 3, D.L., 1999

Çengel Y.A.; Boles M.A., **Termodinámica**, McGraw-Hill-Interamericana, 2015

Moran M.J.; Shapiro H.N., **Fundamentos de termodinámica técnica**, Editorial reverté, S.A., 2004

Bergman T.L., Lavine A.S., Incropera F.P., DeWitt D.P., **Fundamentals of Heat and Mass Transfer**, 8th, 2018

### Complementary Bibliography

Múñoz Domínguez, M.; Rovira de Antonio, A.J., **Ingeniería Térmica**, UNED, 2006

Potter M.C.; Somerton C.W., **Termodinámica para ingenieros**, McGraw-Hill/Interamericana de España, D.L., 2004

Rey Martínez F.J.; Velasco Gómez E., **Bombas de calor y energías renovables en edificios**, 2005

## Recommendations