



## IDENTIFYING DATA

### Thermal technology

Subject	Thermal technology			
Code	V12G363V01704			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	4th	1st
Teaching language	English			
Department				
Coordinator	Gómez Rodríguez, Miguel Ángel			
Lecturers	Gómez Rodríguez, Miguel Ángel			
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Web				
General description	<p>In this subject, it is expected that the student acquire the essential knowledges that allow them to understand the operation of the thermal machines and the processes that take place in their interior, as well as that know the main types of machines and installations and their components. This knowledge results basic for the analysis of the operation, design and construction of the thermal machines and of their thermal setups, and in general, the industrial applications of the thermal engineering.</p> <p>The subject is focused on energy efficiency as well as environmental and social aspects. These are applied to systems using thermal cycles: power cycles (gas and steam) and in refrigeration and heat pump cycles, as well as the use of different renewable fuels.</p>			

## Skills

Code	
B4	CG4 Ability to solve problems through initiative, decision-making, creativity, critical reasoning, and to communicate and transmit knowledge, skills and abilities in the field of industrial engineering.
B5	CG5 Knowledge to carry out measurements, calculations, assessments, appraisals, surveys, studies, reports, work plans and other similar works.
B6	CG6 Capacity for handling specifications, regulations and mandatory standards.
B7	CG7 Ability to analyze and assess the social and environmental impact of the technical solutions.
B11	CG11 Knowledge, understanding and ability to apply the legislation relating to industrial installations.
C7	CE7 Knowledge of applied thermodynamics and heat transfer. Basic principles and their application to solving engineering problems.
D2	CT2 Problem solving.
D7	CT7 Ability to organize and plan.
D9	CT9 Application of knowledge.
D10	CT10 Self learning and work.
D17	CT17 Working as a team.
D20	CT20 Ability to communicate with people not expert in the field.

## Learning outcomes

Expected results from this subject	Training and Learning Results		
Ability to know, understand, use and design energy systems by applying the principles and fundamentals of thermodynamics and thermostatic and fundamentals of thermodynamics and energy transmission.	B4	C7	D2
	B5		D9
Understanding the fundamentals of combustion	B4	C7	D2
	B5		D7
	B7		D9

Understanding the fundamentals of heat engines	B4 B5 B7	C7	D2 D7 D9
Understanding the fundamentals of a thermal power plant operation	B4 B5 B6 B11	C7	D2 D9 D10 D17 D20

## Contents

Topic	
INTRODUCTION	1. Energy issues. Society and energy use 2. Energy production and consumption
HEAT EXCHANGERS	1. Classification of the heat exchangers 2. Calculation of the main parameters 3. Dimensioning 4. Method of the mean logarithmic temperature 5. Method E-NTU
COMBUSTION	1. Introduction 2. Types of combustion 3. Minimum or theoretical air 4. Excess combustion air 5. Combustion fumes 6. Incomplete combustion 7. Combustion diagrams 8. Combustion efficiency
HUMID AIR	1. Introduction 2. Moisture indices 3. Enthalpy of moist air 4. Dew point 5. Adiabatic saturation temperature 6. Wet bulb temperature 7. Psychrometric: Moist air diagrams 8. Mixing of two or more humid airs 9. Mixing of an air mass with water, steam and/or heat 10. Air conditioning processes
THERMAL MACHINES	1. Thermal machines. General 2. Rankine cycle 3. Rankine cycle with regeneration 4. Gas turbines 5. Burners 6. Boilers: definition and typology 7. Energy efficiency 8. Design of heat and water systems in buildings
POWER PLANTS TECHNOLOGY	1. Steam thermal power plant technology 2. Combined cycle power plant technology 3. Nuclear power plant technology 4. Cogeneration
AIR-CONDITIONING INSTALLATIONS	1. Introduction 2. Refrigeration cycle 3. Heat pump 4. Heat pump components 5. Operating characteristics 6. Design of air-conditioning systems 7. Energy efficiency
INTRODUCTION TO THERMAL ENGINES	1. Classification of internal combustion engines 2. Operation of reciprocating internal combustion engines 3. Parts of reciprocating internal combustion engines 4. Nomenclature and basic parameters 5. Theoretical cycles 6. Real cycles

## Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	20	21	41
Laboratory practical	4.5	0	4.5

Problem solving	8	14.5	22.5
Practices through ICT	2	0	2
Studies excursion	9	0	9
Mentored work	3	64	67
Problem and/or exercise solving	1	0	1
Essay questions exam	3	0	3

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

<b>Methodologies</b>	
	Description
Lecturing	Classical lectures on the blackboard supported by slides, videos and any other material that the lecturer considers useful to make the any material that the teacher considers useful to make the subject matter of the course understandable
Laboratory practical	Performance of applied laboratory practices. The activities will consist of disassembling thermal engines, measuring thermal engines, measurement of emissions...
Problem solving	Exercises solving and case studies necessary for the preparation of theory classes
Practices through ICT	Solving exercises with the support of computer programmes
Studies excursion	Visits to installations to learn about the industrial level equipment explained in the lectures
Mentored work	Individual and/or group supervised work. This activity includes the presentation presentation of this work to the group and its subsequent evaluation

<b>Personalized assistance</b>	
<b>Methodologies</b>	<b>Description</b>
Lecturing	Doubts statement during tutorial hours. The student will raise, during the time dedicated to to the tutorials, the doubts concerning the contents developed in the subject, and/or exercises or problems that arise concerning the application of the contents.
Laboratory practical	Raising doubts during practice hours. The student will raise, during the time dedicated to the doubts related to the concepts and development of the aforementioned practical sessions
Problem solving	Raising doubts during tutorial hours. The student will raise, during the time dedicated to tutorials, the doubts concerning the contents that are developed in the subject, and/or exercises or problems that arise relating to the application of the contents
Mentored work	The student will raise doubts during tutorials or in the classes dedicated to the preparation of the work regarding its preparation and the preparation and development of the work
<b>Tests</b>	<b>Description</b>
Problem and/or exercise solving	
Essay questions exam	

<b>Assessment</b>						
	Description	Qualification	Training and Learning Results			
Mentored work	Delivery of the reports of the work carried out and oral presentation of the same. Resolution of problems raised during the course.	10	B4 B5 B6 B7 B11	C7	D2 D7 D9 D10 D17 D20	
Problem and/or exercise solving	Partial exams taken along the course during class hours.	20	B4 B5 B6 B7 B11	C7	D2 D7 D9 D10 D17 D20	
Essay questions exam	Final exam that will collect all the contents taught during the course. The exam will consist of problem solving and questions where both theoretical and practical content will be evaluated.	70	B4 B5 B6 B7 B11	C7	D2 D7 D9 D10 D17 D20	

### **Other comments on the Evaluation**

Ethical commitment: The learner is expected to display appropriate ethical behaviour. If unethical behaviour (copying,

plagiarism, unauthorised unethical behaviour (copying, plagiarism, unauthorised use of electronic devices, etc.), the student is considered to be ineligible to pass the course. student does not meet the necessary requirements to pass the subject. In this case the overall grade for the current academic year will be a fail (0.0). academic year will be a fail (0.0). The use of any electronic device will not be allowed during the assessment tests unless expressly.

evaluation tests unless expressly authorised. Bringing an unauthorised electronic device into the exam room will be considered as a reason for failing the exam. will be considered as a reason for not passing the subject in the current academic year and the overall grade will be a fail (0.0).

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### **Sources of information**

#### **Basic Bibliography**

Çengel Yunus A., Boles Michael A, **Thermodynamics: an engineering approach**, 7th ed, McGraw-Hil, 2011

Çengel, Yunus A., **Heat and mass transfer: a practical approach**, 4th ed, McGraw-Hill, 2011

Moran M.J.; Shapiro H.N., **Fundamentals of thermodynamics**, 8th ed. Wiley,

Incropera, F.P. et al, **Principles of heat and mass transfer**, 7th ed., international student version, Hoboken, N.J. : John Wiley,,

#### **Complementary Bibliography**

Heywood, J.B., **Internal combustion engines fundamentals**, McGraw-Hill,

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### **Recommendations**

#### **Subjects that it is recommended to have taken before**

Physics: Physics 1/V12G360V01102

Physics: Physics 2/V12G360V01202

Mathematics: Calculus 1/V12G360V01104

Mathematics: Calculus 2 and differential equations/V12G360V01204

Thermodynamics and heat transfer/V12G360V01405

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