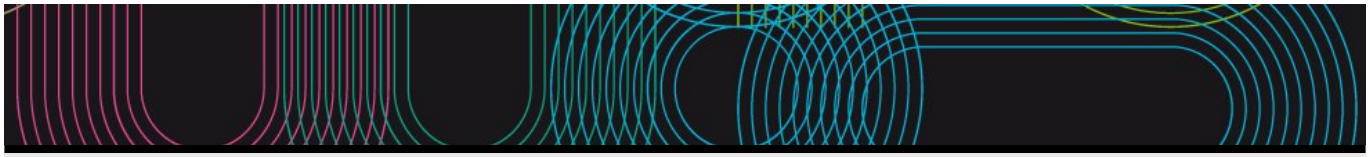

IDENTIFYING DATA				
Thermal technology				
Subject	Thermal technology			
Code	V12G363V01704			
Study programme	Grado en Ingeniería en Tecnologías Industriales			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	4th	1st
Teaching language	English			
Department				
Coordinator	Gómez Rodríguez, Miguel Ángel			
Lecturers	Gómez Rodríguez, Miguel Ángel			
E-mail	miguelgr@uvigo.es			
Web				
General description				

Skills	
Code	
B4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking 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 Problems resolution.
D7	CT7 Ability to organize and plan.
D9	CT9 Apply 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 B5	C7	D2 D9
Understanding the fundamentals of combustion	B4 B5 B7	C7	D2 D7 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
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
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
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
RENEWABLE ENERGY SOURCES OF INDUSTRIAL INTEREST	1. The potential of renewable energies 2. Solar thermal energy 3. Biomass and waste fuels

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	21	21	42
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	6	64	70

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

Methodologies	
	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

Personalized assistance

Methodologies	Description
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

Assessment

	Description	Qualification	Training and Learning Results		
Problem solving	Final written exam on theory and problems	80	B4 B5 B6 B7 B11	C7	D2 D9 D10
Mentored work	Submission of the reports of the work carried out and oral presentation of them. oral presentation of the same. Resolution of problems and short questions during the course. during the course	20	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).

Sources of information

Basic Bibliography

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,,

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

Complementary Bibliography

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

Agüera Soriano, J., **Termodinámica lógica y Motores Térmicos**, Ciencia 3,

Payri, F.; Desantes, J.M., **Motores de combustión interna alternativos**, Reverté,

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

Contingency plan

Description

=== EXCEPTIONAL PLANNING ===
Given the uncertain and unpredictable evolution of the health alert caused by COVID-19, the University of Vigo establishes an extraordinary planning that will be activated when the administrations and the institution itself determine it, considering safety, health and responsibility criteria both in distance and blended learning. These already planned measures guarantee, at the required time, the development of teaching in a more agile and effective way, as it is known in advance (or well in advance) by the students and teachers through the standardized tool.

=== ADAPTATION OF THE METHODOLOGIES ===
* Teaching methodologies maintained

* Teaching methodologies modified

* Non-attendance mechanisms for student attention (tutoring)

* Modifications (if applicable) of the contents

* Additional bibliography to facilitate self-learning

* Other modifications

=== ADAPTATION OF THE TESTS ===
* Tests already carried out
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...

* Pending tests that are maintained
Test XX: [Previous Weight 00%] [Proposed Weight 00%]
...

* Tests that are modified
[Previous test] => [New test]

* New tests

* Additional Information