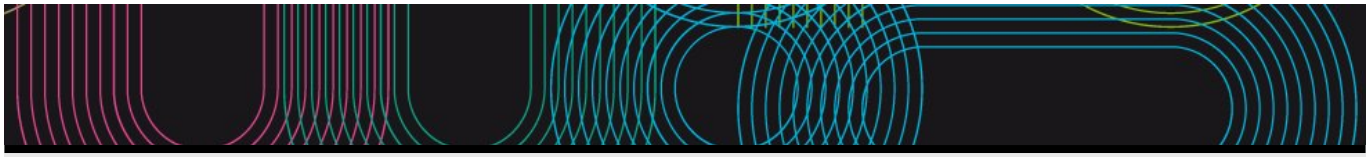

IDENTIFYING DATA				
(*)Motores e máquinas térmicos				
Subject	(*)Motores e máquinas térmicos			
Code	V12G380V01913			
Study programme	(*)Grao en Enxeñaría Mecánica			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	9	Optional	4th	1st
Teaching language	Spanish			
Department				
Coordinator	Patiño Vilas, David			
Lecturers	Febrero Garrido, Lara Patiño Vilas, David			
E-mail	patinho@uvigo.es			
Web				
General description				

Competencies	
Code	
A3	CG3 Knowledge in basic and technological subjects that will enable students to learn new methods and theories, and provide them the versatility to adapt to new situations.
A4	CG4 Ability to solve problems with initiative, decision making, creativity, critical thinking and the ability to communicate and transmit knowledge and skills in the field of industrial engineering.
A5	CG5 Knowledge to carry out measurements, calculations, assessments, appraisals, surveys, studies, reports, work plans and other similar works.
A6	CG6 Capacity for handling specifications, regulations and mandatory standards.
A7	CG7 Ability to analyze and assess the social and environmental impact of the technical solutions.
A11	CG11 Knowledge, understanding and ability to apply the necessary legislation in the exercise of the profession of Industrial Technical Engineer.
B1	CT1 Analysis and synthesis
B2	CT2 Problems resolution.
B3	CT3 Oral and written proficiency in the own language.
B6	CT6 Application of computer science in the field of study.
B7	CT7 Ability to organize and plan.
B9	CS1 Apply knowledge.
B10	CS2 Self learning and work.
B15	CP1 Objectification, identification and organization.
B16	CP2 Critical thinking.
B17	CP3 Working as a team.
B20	CP6 Ability to communicate with people not expert in the field.

Learning aims		
Expected results from this subject		Training and Learning Results
(*)	A3	
(*)	A4	
(*)	A5	
(*)	A6	
(*)	A7	
(*)	A11	
(*)		B1

(*)	B2
(*)	B3
(*)	B6
(*)	B7
(*)	B9
(*)	B10
(*)	B15
(*)	B16
(*)	B17
(*)	B20

Contents

Topic	
1. Introduction to Thermal Engines	1.1 Presentation of the subject 1.2 Basic definitions
2. Characteristics of the Internal Combustion Engines (ICE)	2.1 Classification of the thermal engines 2.2 Fundamentals of the Internal Combustion Engines (ICE) 2.3 Parts of the ICEs 2.4 Nomenclature and basic parameters
3. Air Cycle	3.1 Thermodynamic Cycle 3.2 The Otto Cycle 3.3 The Limited Pressure Cycle 3.4 The Diesel Cycle
4. The Real Cycle	4.1 The mixture of real gas 4.2 Evolution of the adiabatic coefficient 4.3 Pumping Loss 4.4 Combustion Loss 4.5 Expansion Loss 4.6 Quality Factor of the Cycle
5. Gas exchange processes in 4 Stroke Engines	5.1 The Valve Train 5.2 The Volumetric Efficiency 5.3 Pump loss 5.4 Timing 5.5 Variable Distribution Systems 5.6 Dynamic Air admition systems
6. Scavenging in 2 Stroke Engines	6.1 Ideal Scavenging 6.2 Scavenging proccess 6.3 Admision systems 6.4 Acoustic wave enhancement
7. Supercharging	7.1 Advantages of the supercharging in ICE 7.2 Volumetric superchargers 7.3 Turbochargers 7.4 Intercooler 7.5 Dynamic Systems (Comprex)
8. Combustion in Spark Ignition Engines (SIE)	8.1 Stoichiometry of SIE 8.2 Characteristic Curves 8.3 The Carburettor 8.4 Injection System 8.5 Closed loop (lambda control) 8.6 Combustion phases in SI 8.7 Abnormal Combustion: knock 8.8 Abnormal Combustion: superficial ignition 8.9 Combustion chambers 8.10 Influential factors in SI combustion
9. Combustion in Compression Ignition Engines (CIE)	9.1 Introduction 9.2 Phases of CI combustion 9.3 Influential Factors 9.4 Types of injection 9.5 Systems of injection 9.6 Future tendencies
10. Thermal turbomachinery	10.1 Brayton Cycle 10.2 Parts of the Gas Turbine 10.3 Compressors 10.4 Combustion Chamber 10.5 Turbine 10.6 Architecture

11. Auxiliar Circuits	11.1 Refrigeration System 11.2 Lubricacion System
12. Pollution Emissions	12.1 SI Emissions 12.2 Diesel Emissiones 12.3 Regulations (EURO) 12.4 Catalytic converter 12.5 EGR systems 12.6 Lambda
13. Other thermal engines	13.1 Rotary Engine (Wankel) 13.2 Stirling Engine 13.3 Modern Tendencies (HCCI, hybrids...) 13.4 New Fuels
14. Boilers and Industrial Furnaces	14.1 Classification of the boilers 14.2 Heat exchanger types 14.3 Fixed-bed boilers 14.4 fluidized-bed boilers 14.5 Heat losses in boilers 14.6 industrial Furnaces
15. Refrigeration	15.1 Introduction 15.2 Simple Compression Cycle 15.3 Compression Cycle with stages 15.4 Heat Pump 15.5 Other refrigeration systems: Absorption 15.6 Refrigerants

Planning

	Class hours	Hours outside the classroom	Total hours
Master Session	42	89	131
Laboratory practises	24	0	24
Tutored works	0	30	30
Troubleshooting and / or exercises	10	30	40

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

Methodologies

	Description
Master Session	
Laboratory practises	(*) Realizacións de prácticas de laboratorio aplicadas. As actvidades consistirán no desmontaxe de motores térmicos, utilización de banco de potencia, medición de emisións...
Tutored works	(*) Realización de traballos tutelados individuais e/ou en grupo. Dentro desta actividade inclúese tamén a presentación de ditos traballos ante o grupo e a súa posterior avaliación.
Troubleshooting and / or exercises	(*) Resolución de exercicios e casos prácticos necesarios para a preparación das clases de teoría.

Personalized attention

Methodologies	Description
Master Session	At the beginning of the semester, the professor informs about his schedule. The students can solve their doubts or receive help for the tutorized work during this time. Otherwise, the professor could be contacted anytime by email or by means of the platform FAITIC
Laboratory practises	At the beginning of the semester, the professor informs about his schedule. The students can solve their doubts or receive help for the tutorized work during this time. Otherwise, the professor could be contacted anytime by email or by means of the platform FAITIC
Tutored works	At the beginning of the semester, the professor informs about his schedule. The students can solve their doubts or receive help for the tutorized work during this time. Otherwise, the professor could be contacted anytime by email or by means of the platform FAITIC
Troubleshooting and / or exercises	At the beginning of the semester, the professor informs about his schedule. The students can solve their doubts or receive help for the tutorized work during this time. Otherwise, the professor could be contacted anytime by email or by means of the platform FAITIC

Assessment

	Description	Qualification
Master Session	Short answer questions or test	50
Tutored works	Oral presentation of a report	15
Troubleshooting and / or exercises	Resolution of exercices	35

Other comments on the Evaluation

Sources of information

Moran J and Shapiro H, **Fundamentos de Termodinámica Técnica**, Ed. Reverté,

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

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

Muñoz M. y Payri F, **Motores de combustión interna alternativos**, Publicaciones de la UP Valencia,

Mollenhauer K. y Tschöke H, **Handbook of Diesel Engines.**, Ed. Springer,

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

Gordon P. Blair, **Design and simulation of four-stroke engines**, Editado por SAE Internacional,

Taylor C.F., **The internal combustion engine in theory and practice: vol. 1. Thermodynamics, fluid flow, performance.**, Editorial MIT press,

Taylor C.F., **The internal combustion engine in theory and practice: vol. 2. Combustions, fuels, materials, design**, Editorial MIT press,

Recommendations

Subjects that it is recommended to have taken before

(*)Teoría de máquinas e mecanismos/V12G380V01306

(*)Termodinámica e transmisión de calor/V12G380V01302

(*)Enxeñaría térmica I/V12G380V01501