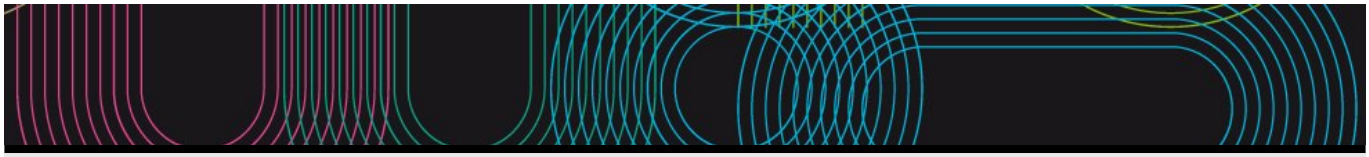

IDENTIFYING DATA				
Thermal engineering I				
Subject	Thermal engineering I			
Code	V12G380V01501			
Study programme	Grado en Ingeniería Mecánica			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	9	Mandatory	3rd	1st
Teaching language	Spanish			
Department				
Coordinator	Cerdeira Pérez, Fernando			
Lecturers	Cerdeira Pérez, Fernando Diz Montero, Rubén Pequeño Aboy, Horacio			
E-mail	nano@uvigo.es			
Web	http://moovi.uvigo.gal/			
General description	Acquisition of knowledges to comprise the operation of the thermal machines and the processes that take place in his interior, as well as 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.			

Skills	
Code	
B1	CG1 Skills for writing, signing and developing projects in the field of industrial engineering, whose purpose, specializing in Mechanics, construction, alteration, repair, maintenance, demolition, manufacturing, installation, assembly or operation of: structures, mechanical equipments, energy facilities, electrical systems and electronic installations and industrial plants, and manufacturing processes and automation.
C21	CE21 Knowledge applied to thermal engineering.
D1	CT1 Analysis and synthesis
D2	CT2 Problems resolution.
D6	CT6 Application of computer science in the field of study.
D8	CT8 Decision making.
D10	CT10 Self learning and work.
D14	CT14 Creativity.
D16	CT16 Critical thinking.
D17	CT17 Working as a team.

Learning outcomes			
Expected results from this subject	Training and Learning Results		
(*)	B1	C21	D1 D2 D10
(*)	B1	C21	D1 D2 D6 D10 D16 D17

(*)		C21	D1 D2 D6 D10 D14 D16
(*)	B1	C21	D1 D2 D6 D8 D10 D14 D16 D17
New	B1	C21	D1 D2 D8 D10 D17

Contents	
Topic	
Foundations of the combustion.	Introduction. Types of combustion.
Fuels employed in engines and thermal installations.	Classification. Properties. Distribution of gases fuels
Study of the humid air.	Introduction. Variables psycrometrics. Diagrams psycrometric. Cooling tower.
Heat Exchangers.	Introduction. Classification Thermal balance. Distribution of temperature Analysis of exchangers - Method DTLM - Method NTU
Machines and thermal engines.	Classification. Basic concepts.
Engines of internal combustion.	Real cycles and theorists. Main components. Parameters characteristics. Characteristic curves. Auxiliary systems: refrigeration and lubrication.
Installations of power with cycle of steam.	Introduction. Main components. Cycle Rankine. Thermal balance.
Installations of power with cycles of gas.	Introduction. Main components. Cycle Brayton. Thermal balance. Cycle Combined of gas-steam.
Pumping of heat.	Definitions. Cycle of Carnot reverse. Cycle of mechanical compression. Bomb of heat. Refrigeration by absorption. Refrigerants.
Boilers and Burners.	Classification. Definitions. Types. Energetic balance.
Compressors.	Previous concepts. Reciprocating compressors. Rotary compressors.

Processes of spill.	Properties of stagnation. Speed of the sound and nº of Mach. Flow isentropic through nozzles and diffusers.
-- Laboratory practices.	- Determination of the enthalpy of combustion. - 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 the air compressors. - Energetic balance of a boiler. - Visit to a boilers room.
-- Practical with support of the TIC	- Calculation of a LPG deposit.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	38	50	88
Problem solving	14	40	54
Practices through ICT	4	4	8
Laboratory practical	16	12	28
Mentored work	0	10	10
Autonomous problem solving	0	25	25
Field practice	1	2	3
Problem and/or exercise solving	3	0	3
Objective questions exam	2	4	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.
Mentored work	Activity directed to develop exercises or projects under the guidelines and supervision of the professor. His development can be linked with autonomous activities of the student, practices of laboratory,.... Activity in group or individual. The work developed can finally be exposed publicly in the classroom.
Autonomous problem solving	Resolution of problems and/or exercises related with the subject that the student will make out of the classroom.
Field practice	A visit to a boiler room is made to learn safety aspects of engineering practice. Students will be expected to identify potential risks, existing protection measures or devices or safety distances, among others, and when possible, measures will be taken to learn about both energy efficiency and environmental aspects. To do this, it asks them to carry out a prior bibliographic search of the mandatory standard. This action is completed with a brief questionnaire on notions of industrial health and safety.

Personalized assistance

Methodologies	Description
Autonomous problem solving	The students will be able to resolve the doubts of the matter and of the distinct bulletins of problems in the schedule of tutorials fixed by the professors of the matter.

Assessment

	Description	Qualification	Training and Learning Results
Problem and/or exercise solving	Examination (writen, oral,...) consisting in the resolution of problems and/or exercises.	60	B1 C21 D1 D2 D8 D10 D14 D16

Objective questions exam	During the development of the course, the students will have to make several questionnaires composed by theoretical objective questions and/or resolution of exercises related with the contents developed.	40	C21	D1 D2 D6 D8 D10 D14 D16 D17

Other comments on the Evaluation

The continuous evaluation (EC, 40%) will be evaluated through questionnaires of objective, theoretical and/or practical questions, by those students who have carried out the tasks proposed (practical,...) by the teachers during the academic year; Those who have officially resigned from the EC will have to complete a specific questionnaire (SQ) 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).

Ethic Commitment: It is expected an adequate ethical behaviour of thestudent. In case of detecting unethical behaviour (copying, plagiarism,unauthorized use of electronic devices, etc.) shall be deemed that the studentdoes not meet the requirements for passing the subject. In this case, theoverall rating in the current academic year will be Fail (0.0).
The use of any electronic device for the assessmenttests 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.,
Moran M.J.; Shapiro H.N., **Fundamentos de termodinámica técnica**, Editorial reverté, S.A.,
Çengel Y.A.; Boles M.A., **Termodinámica**, McGraw-Hill-Interamericana,
Incropera, Frank P., **Fundamentos de transferencia de calor**, Prentice Hall,

Complementary Bibliography

Potter M.C.; Somerton C.W., **Termodinámica para ingenieros**, McGraw-Hill/Interamericana de España, D.L.,
Múñoz Domínguez, M.; Rovira de Antonio, A.J., **Ingeniería Térmica**, UNED,
Çengel Y.A.; Ghajar, A.J., **Transferencia de calor y masa**, McGraw-Hill/Interamericana de España, D.L.,
Kohan, Anthony L., **Manual de calderas**, McGraw-Hill,

Recommendations

Subjects that it is recommended to have taken before

Physics: Physics I/V12G380V01102
Physics: Physics II/V12G380V01202
Chemistry: Chemistry/V12G380V01205
Thermodynamics and heat transfer/V12G380V01302

Other comments

To enrol in this subject is necessary to have surpassed or be enrolled of all the subjects of the inferior courses.