



Teaching Guide

Teaching Guide				
Identifying Data				2019/20
Subject (*)	Thermodynamics		Code	730G03014
Study programme	Grao en Enxeñaría Mecánica			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	1st four-month period	Second	Obligatory	6
Language	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	Ciencias da Navegación e Enxeñaría MariñaEnxeñaría Naval e Industrial			
Coordinador	Calvo Diaz, Jose Ramon		E-mail	jose.ramon.calvo@udc.es
Lecturers	Calvo Diaz, Jose Ramon		E-mail	jose.ramon.calvo@udc.es
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Web	www.udc.es			
General description	Heat, work, and energy.			

Study programme competences

Code	Study programme competences
A7	CR1 - Coñecementos de termodinámica aplicada e transmisión de calor. Principios básicos e a súa aplicación á resolución de problemas de enxeñaría.
B1	CB01 - Que os estudantes demostraren posuír e comprender coñecementos nunha área de estudo que parte da base da educación secundaria xeral e adoita encontrarse a un nivel que, aínda que se apoia en libros de texto avanzados, inclúe tamén algúns aspectos que implican coñecementos procedentes da vangarda do seu campo de estudo
B3	CB03 - Que os estudantes teñan a capacidade de reunir e interpretar datos relevantes (normalmente dentro da súa área de estudo) para emitiren xuízos que inclúan unha reflexión sobre temas relevantes de índole social, científica ou ética
B5	CB05 - Que os estudantes desenvolvan aquelas habilidades de aprendizaxe necesarias para emprenderen estudos posteriores cun alto grao de autonomía
B7	B5 - Ser capaz de realizar unha análise crítica, avaliación e síntese de ideas novas e complexas
B9	B8 - Adquirir unha formación metodolóxica que garanta o desenvolvemento de proxectos de investigación (de carácter cuantitativo e/ou cualitativo) cunha finalidade estratéxica e que contribúan a situarnos na vangarda do coñecemento
C4	C6 - Valorar criticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben enfrontarse.
C6	C8 - Valorar a importancia que ten a investigación, a innovación e o desenvolvemento tecnolóxico no avance socioeconómico e cultural da sociedade.

Learning outcomes

Learning outcomes	Study programme competences		
Learn thermodynamics and heat transfer. Fundamentals and application to engineering.	A7	B1 B3 B5 B7 B9	C4 C6

Contents

Topic	Sub-topic
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The following blocks or chapters develop the contents established in the verification memory, which are:	Fundamentals Energy and conservation of energy Entropy Exergy Problems applied to engineering
1. Introduction to thermodynamics	Thermodynamics and energy Systems and control volumes Properties States Processes Energy and enthalpy Specific heat and thermal capacity Phases Ideal gases Temperature and Zeroth Law of Thermodynamics Density Pressure
2. Work, energy and the 1st Law of Thermodynamics (conservation of energy)	Energy Energy transfer by heat Energy transfer by work The First Law of Thermodynamics for closed systems, energy balance
3. Propiedades de una sustancia pura	Introduction Phase-change processes of pure substances Property diagrams Property tables Properties of incompressible substances Properties of ideal gases Reference states
4. Conservation of energy and 1st law of Thermodynamics	Introduction Conservation of mass in control volumes Conservation of energy in control volumes Examples
5. 2nd Law of Thermodynamics and introduction to thermodynamic cycles	Introduction Thermal energy reservoirs Thermodynamic cyclic devices: heat engines, refrigerators and heat pumps Kelvin-Planck and Clausius statements for the Second Law of Thermodynamics Maximum thermal efficiency of thermodynamic cyclic devices
6. Entropy	Clausius inequality Entropy Entropy tables Entropy diagrams Tds relations Entropy change of thermal energy reservoirs Entropy change of incompressible substances Entropy change of ideal gases Entropy generation Isentropic processes Entropy balance for closed systems and control volumes Entropy of the universe Isentropic efficiency of pumps, compressors, turbines and nozzles



Planning

Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
ICT practicals	A7 B1 B3 B5 B7 B9 C4 C6	22	44	66
Guest lecture / keynote speech	A7 B1 B3 B5 B7 B9 C4 C6	21	42	63
Introductory activities	A7 B1 B3 B5 B7 B9 C6 C4	10	0	10
Mixed objective/subjective test	A7 B1 B3 B5 B7 B9 C4 C6	4	6	10
Personalized attention		1	0	1

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

Methodologies

Methodologies	Description
ICT practicals	Classes using computers
Guest lecture / keynote speech	Classes
Introductory activities	Partial exam with initial aspects
Mixed objective/subjective test	Exam/s

Personalized attention

Methodologies	Description
ICT practicals	Personal attention will be provided by tutorials and e-mail.
Mixed objective/subjective test	Academic dispense is allowed. Students who request it must contact teacher to realize additional homework.
Introductory activities	

Assessment

Methodologies	Competencies	Description	Qualification
ICT practicals	A7 B1 B3 B5 B7 B9 C4 C6	Students may deliver some exercises.	20
Mixed objective/subjective test	A7 B1 B3 B5 B7 B9 C4 C6	Exam/s.	70
Introductory activities	A7 B1 B3 B5 B7 B9 C6 C4	Partial exam with initial aspects.	10
Others			

Assessment comments



Students

who request academic dispense must realize other activities proposed by the teacher. The qualification is the same as the practice.

The evaluation criteria of the 2nd opportunity are the same as those of the 1st opportunity except that, in case of partial exams, the mark obtained in these will not be taken into account in the 2nd opportunity.

In order to pass it is necessary to obtain at least 4 in the final exam and 5 in the global score.

Sources of information

Basic	- J. M^a Sáiz Jabardo (). Introducción a la Termodinámica. - M. Moran y H. N Shapiro (). Fundamentos de Termodinámica Técnica. John Wiley & Sons - Y. A. Çengel; M. A. Boles. (). Thermodynamics. McGraw-Hill - Y. A. Çengel (). Ecuaciones Diferenciales para Ingeniería y Ciencias. McGraw-Hill
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Complementary

Recommendations

Subjects that it is recommended to have taken before

CALCULUS/730G01101
PHYSICS I/730G01102
DIFFERENTIAL EQUATIONS/730G01110
MECHANICS/730G01118

Subjects that are recommended to be taken simultaneously

Subjects that continue the syllabus

FLUID MECHANICS/730G01119
Industrial Heat Transfer/730G03020
Fluid and Thermal Machines/730G03023

Other comments

proposed to correct them.

5/5