UNIVERSIDADE DA CORUÑA

Teaching Guide

Identifying Data				2014/15	
Subject (*)	Termodinámica técnica		**Code**	730G05015	
Study programme	Grao en Enxeñaría Naval e Oceánica				

Descriptors					
Cycle	**Period**	**Year**	**Type**	**Credits**	
Graduate	1st four-month period	Second	Obligatoria	6	
Language	Spanish				
Prerequisites					
Department	Enxeñaría Naval e Oceánica				
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General description					

Study programme competences	
Code	**Study programme competences**
A1	Skill for the resolution of the mathematical problems that can be formulated in the engineering. Aptitude for applying the knowledge on: linear algebra; geometry; differential geometry; differential and integral calculation; differential equations and in partial derivatives; numerical methods; algorithmic numerical; statistics and optimization
A2	Understanding and domination of the basic concepts on the general laws of the, thermodynamics, mechanics, fields and waves and electromagnetism and its application for the resolution of problems characteristic of the engineering

Learning outcomes	
Subject competencies (Learning outcomes)	**Study programme competences**
(1) Modelar matematicamente sistemas e procesos relacionados a la utilización y generación de la energía	A1
(2) Aprender a aprender	A2
(3) Resolver problemas de forma efectiva.	A1
(7) Capacidad de abstracción, comprensión y simplificación de problemas complejos.	A2

Contents	
Topic	**Sub-topic**
1. Introduction to Thermodynamics	Applications of Thermodynamics. Continuum medium. Basic concepts: system, surroundings, state, thermodynamical property, equilibrium. Characterization and measurement of primitive properties: pressure, volume, temperature. Temperature scale. Gas thermometer.
2. Work, energy and the 1st law of Thermodynamics (conservation of energy)	Review of mechanical concepts of energy. Examples: energy balance. Concept of work. Electric work. Examples. Cuasi-equilibrium processes and work. Heat iteration. Examples of heat and work. Internal energy and total energy. Conservation of energy. Heat transfer at constant pressure and volume. Enthalpy. Internal energy and enthalpy of ideal gasses and compressible flows. Tables of ideal gasses.
3. Propiedades de una sustancia pura	Ideal gas equation of state and characterization of the state using two independent properties. Incompressible flows. Phase diagrams and phases of a pure substance. Pure simple compressible substances. Characterization of pure simple compressible substances. Equation of state and thermodynamical surfaces. (p, v) and (T, v) diagrams of a pure simple compressible substance. Tables of thermodynamic properties and reference states for water refrigerants. Examples.

4. Conservation of energy and 1st law of Thermodynamics	Vapor turbines, hydraulic turbines, compressors, nozzles, heat exchangers. Concept of control volume (open system). Conservation of mass. Examples. Conservation of energy and input/output works. Conservation of mass and energy applied to thermal machines. Steady and transient states. Filling and emptying of tanks.
5. 2nd law of Thermodynamics and introduction to thermodynamic cycles	Concept of reversibility. Irreversible processes. Spontaneous processes. Internally reversible processes. Thermal reservoir. Power cycles and refrigerators. Efficiency and coefficient of performance (COP). 2nd law of Thermodynamics: Kelvin-Plank and Clausius statements. Equivalence between both statements. Carnot cycle of an ideal gas inside a cylinder-piston system. Efficiency of a reversible power cycle. Corollaries of the 2nd law of thermodynamics. Kelvin temperature scale. Clausius inequality.
6. Entropy	Analogy between work-pressure and heat-temperature in reversible process. Entropy as thermodynamic property. Thermodynamic equations related to entropy. Equations for ideal gasses. Tables of properties for pure simple compressible substances. (T, s) and (h, s) diagrams. Generation of entropy in irreversible processes. Generation and transfer of entropy. Open system. Application to thermal machines. Efficiency in thermal machines: compressors, pumps, turbines, nozzles. Applications.

Planning			
Methodologies / tests	Ordinary class hours	Student?s personal work hours	Total hours
ICT practicals	30	40	70
Guest lecture / keynote speech	40	30	70
Long answer / essay questions	9	0	9
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	Students learn the software EES (Engineering Equation Solver). Thermodynamical problems will be solved using EES. There will also be lab work.
Guest lecture / keynote speech	Conventional classes.
Long answer / essay questions	Two exams

Personalized attention	
Methodologies	Description
ICT practicals	Personal attention will be provided to the students.

Assessment		
Methodologies	Description	Qualification
Long answer / essay questions	First exam: 30% Second exam: 70%	80
ICT practicals	Students may deliver some exercises and lab work	20
Others		

Assessment comments

Sources of information	
Basic	- M. Moran y H. N Shapiro (2004). Fundamentals of Engineering Thermodynamics. John Willey &amp; Sons
	- J. Mª Sáiz Jabardo (2008). Introducción a la Termodinámica.
	- Y. A. Çengel y M. A. Boles. (2006). Thermodynamics. McGraw-Hill
Complementary	

Recommendations
Subjects that it is recommended to have taken before
FLUID MECHANICS/730G01119
CALOR E FRIO INDUSTRIAL/REFRIG/730G03020
MÁQUINAS TERMICAS E HIDRAULICAS/730G03023
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
CALCULUS/730G01101
PHYSICS I/730G01102
DIFFERENTIAL EQUATIONS/730G01110
MECHANICS/730G01118
Other comments

(*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.