UNIVERSIDADE DA CORUÑA

Teaching Guide				
Identifying Data				2015/16
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			
Teaching method	Face-to-face			
Prerequisites				
Department	Enxeñaría Naval e Oceánica			
Coordinador	Lamas Galdo, Isabel	E-mail	isabel.lamas.galdo@udc.es	
Lecturers	Calvo Diaz, Jose Ramon Garcia Del Valle, Javier Lamas Galdo, Isabel	E-mail	jose.ramon.calvo@udc.es javier.garciad@udc.es isabel.lamas.galdo@udc.es	
Web	www.udc.es			
General description				

Study programme competences	
Code	Study programme competences

Learning outcomes			
Learning outcomes	Study programme competences		
Modelar matematicamente sistemas e procesos relacionados a la utilización y generación de la energía	A7	B1 B3 B5 B7 B9	C4 C6
Aprender a aprender	A7	B1 B3 B5 B7 B9	C4 C6
Resolver problemas de forma efectiva.	A7	B1 B3 B5 B7 B9	C4 C6
Capacidad de abstracción, comprensión y simplificación de problemas complejos.	A7	B1 B3 B5 B7 B9	C4 C6

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	**Competencies**	**Ordinary class hours**	**Student?s personal work hours**	**Total hours**
ICT practicals	A7 B1 B3 B5 B7 B9 C4 C6	30	40	70
Guest lecture / keynote speech	A7 B1 B3 B5 B7 B9 C4 C6	40	30	70
Long answer / essay questions	A7 B1 B3 B5	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	**Competencies**	**Description**	**Qualification**
Long answer / essay questions	A7 B1 B3 B5	Exam/s. In order to pass it is neccesary to obtain at least 3.5 at the final exam and 5 final score.	85
ICT practicals	A7 B1 B3 B5 B7 B9 C4 C6	Students may deliver some exercises and lab work	15
Others			

Assessment comments

Sources of information	
Basic	- J. Mª Sáiz Jabardo (2008). Introducción a la Termodinámica. - M. Moran y H. N Shapiro (2004). Fundamentals of Engineering Thermodynamics. John Willey & Sons - Y. A. Çengel y M. A. Boles. (2006). Thermodynamics. McGraw-Hill
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 CALOR E FRIO INDUSTRIAL/REFRIG/730G03020 MÁQUINAS TERMICAS E HIDRAULICAS/730G03023
Other comments