Teaching Guide					
Identifying Data					2018/19
Subject (*)	Energy Management			Code	631G02557
Study programme	Grao en Tecnoloxías Mariñas				
Descriptors					
Cycle	Period	Year		Type	Credits
Graduate	1st four-month period	Fourth		Optional	6
Language	SpanishGalicianEnglish				
Teaching method	Face-to-face				
Prerequisites					
Department	Ciencias da Navegación e Enxeñaría Mariña				
Coordinador	Carbia Carril, Jose		E-mail	jose.carbia@udc.es	
Lecturers			E-mail		
Web					
General description	In this subject, the acquired prior knowledge is developed to study most of the processes linked to the management of energy in a facility, both on board a ship and on land. As an example, it allows to manage the operation of the different machines that are on board a ship and the processes of recovery of residual energies. It is essential to carry out the processes of optimization and energy management in steam and gas turbines, internal combustion engines, auxiliary systems of the ship, steam generators and heat transfer, combustion processes and formation of pollutants, cold techniques , etc. It is a basic matter for compliance with the STCW regulations, regarding energy efficiency in ships (SEEMP), and the fight against environmental pollution. To take the course, it is advisable to have previous knowledge of physics, mathematics, chemistry, thermodynamics, fluid mechanics, internal combustion engines, steam and gas turbines, refrigeration systems, etc.				

Study programme competences	
Code	Study programme competences
A7	CE7 - Capacidade para a operación e posta en marcha de novas instalacións ou que teñan por obxecto a construción, reforma, reparación, conservación, instalación, montaxe ou explotación, realización de medicións, cálculos, valoracións, taxacións, peritacións, estudos, informes, e outros traballos análogos de instalacións enerxéticas e industriais mariñas, nos seus respectivos casos, tanto con carácter principal como accesorio, sempre que quede comprendido pola súa natureza e característica na técnica propia da titulación, dentro do ámbito da súa especialidade, é dicir, operación e explotación.
A73	CE63 - Coñecer o balance termo-eléctrico do buque, o sistema de mantemento da carga, así como a xestión eficiente da enerxía respectando o medio ambiente
B1	CT1 - Capacidad para gestionar los propios conocimientos y utilizar de forma eficiente técnicas de trabajo intelectual
B5	CT5 - Traballar de forma colaboradora.
B8	CT8 - Versatilidade.
B11	CT11 - Capacidade para resolver problemas con iniciativa, toma de decisións, creatividade, razoamento crítico e de comunicar e transmitir coñecementos habilidades e destrezas.
C2	C2 - Dominar a expresión e a comprensión de forma oral e escrita dun idioma estranxeiro.
C3	C3 - Utilizar as ferramentas básicas das tecnoloxías da información e as comunicacións (TIC) necesarias para o exercicio da súa profesión e para a aprendizaxe ao longo da súa vida.
C9	CB1 - Demostrar que posúen e comprenden coñecementos na área de estudo que parte da base da educación secundaria xeneral, e que inclúe coñecementos procedentes da vanguardia do seu campo de estudo
C10	CB2 - Aplicar os coñecementos no seu traballo ou vocación dunha forma profesional e poseer competencias demostrables por medio da elaboración e defensa de argumentos e resolución de problemas dentro da área dos seus estudos
C11	CB3 - Ter a capacidade de reunir e interpretar datos relevantes para emitir xuicios que inclúan unha reflexión sobre temas relevantes de índole social, científica ou ética
C12	CB4 - Poder transmitir información, ideas, problemas e solucións a un público tanto especializado como non especializado.

C13	CB5 - Ter desenvolvido aquelas habilidades de aprendizaxe necesarias para emprender estudos posteriores con un alto grao de autonomía.

Learning outcomes			
Learning outcomes	Study programme competences		
Know and analyze the thermodynamic processes that take place in thermal engines.	A7 A73	B1 B11	C2 C9 C10 C11
Performing energy balances of thermal installations. Makeing decisions from the point of view of optimization and energy management.	A7 A73	B1 B5	C2 C13
Manage the design, calculation and operation of the components that intervene in marine thermal installations	A7 A73	B1 B5 B8 B11	C3
Management, planning and energy organization of marine thermal installations.	A7 A73	B1 B8	C12

Contents	
Topic	Sub-topic
1.ENERGY AND EXERCETICAL MANAGEMENT OF THERMAL INSTALLATIONS	1.1. Introduction. 1.2. Thermodynamics. Development of energy balance. 1.3. Fundamentals of the concept of exergy. 1.4. Balance of energy and exergy at steady state. 1.5. Application of energetic and exergetic analysis to nozzles, diffusers, turbines, compressors, pumps, heat exchangers and throttling devices. 1.6. Analysis of transitory conditions.
2. MASS TRANSFER PROCESSES	2.1. Introduction. 2.2. Fundamentals of the transfer of matter. 2.3. Principles of diffusion. 2.4. Non-diffusing stationary diffusion. 2.5. DiffusioN in mixtures of several components. Turbulent diffusion. 2.6. Transfer of mass by convection. 2.7. Absorption with chemical reaction.
3. STUDY OF COMBUSTION PROCESSES	3.1. Introdución. 3.2. O servizo de combustible nos buques. 3.2.1. Propiedades físicas e químicas dos combustibles. 3.3. O proceso de combustión. 3.4. Reaccións de combustión. 3.5. Composición dos gases producidos na combustión. 3.6. Punto de orballo dos gases. 3.7. Optimización do proceso de combustión. 3.8. Diagnose da combustión. 3.9. Aspectos enerxéticos da combustión.

4. PROCESSES WITH HEAT TRANSFER	4.1. Introduction. 4.2. Thermotransmission. 4.3. Balance of energy on a surface. 4.4. Analysis of heat transfer problems. Methodology. 4.5. Boiling and condensation. 4.6. Heat exchangers. 4.7. Simultaneous heat and mass transfer
5. ENERGY ANALYSIS OF PROPULSION SYSTEMS	5.1. Introduction. 5.2. Thermal cycles 5.3. Thermal performance and thermal balance of marine installations. 5.4. Propulsion with nuclear energy 5.5 Balances in marine cogeneration facilities. 5.6. Balances in marine refrigeration and air conditioning installations. 5.7. Exergetic analysis of the facilities.
6. ALTERNATIVE SYSTEMS OF ENERGETIC USE	6.1. Introduction. 6.2. Fuel cells. 6.3. Residues of biomass. 6.4. Wind systems for propulsion and energy use. 6.5. Solar energy utilization systems. 6.6. Use of residual energies 6.7. Recovery of VOCs 6.8. Reforming
7. AUDIT, PLANNING AND ENERGY ORGANIZATION OF THERMAL FACILITIES	7.1. Introduction. 7.2. Use of energy 7.3. Material means for the energy audit. 7.4. The data collection and calculations. 7.5. Improvement of the performance and maintenance of the optimal operating conditions of the energy equipment. 7.6. Inspection and review of equipment
8. ENERGY EFFICIENCY IN SHIPS	8.1. Introduction. 8.2. Energy Efficiency Management Plan for ships (SEEMP). 8.3. Energy Efficiency Index design. 8.4. Operational Indicator of Energy Efficiency. 8.5. Application regulations

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A73 C10 C11 C12	24	36	60
Case study	A7 B1 B5 B8 B11 C2 C3 C9 C13	24	48	72
Objective test	A7 A73 B1 B5 B8 B11 C2 C3 C9 C10 C11 C12 C13	4	0	4
Personalized attention		14	0	14
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	Description

Guest lecture / keynote speech	Being will make the detailed explanation of the contents of the subject that are distruyen in subjects, or the student will have bibliographic material of the subject to treat in each master session. The participation of the student in class, through comments, that will encourage to relate the theoretical contents with real experience will be encouraged.
Case study	Proposal of practical cases, resolution and criticism.
Objective test	Written tests will be conducted consisting of theoretical and practical questions.

Personalized attention	
Methodologies	**Description**
Guest lecture / keynote speech Case study Objective test	GUEST LECTURE: Personalized attention in the classroom to the doubts. CASE STUDY: Attention in the office or classroom for the resolution of analysis works. OBJECTIVE TEST: Supervision of the test. CUSTOMIZED ATTENTION: It will be done at tutoring times established at the beginning of the course and shown on the bulletin board of the office.

Assessment			
Methodologies	**Competencies**	**Description**	**Qualification**
Guest lecture / keynote speech	A73 C10 C11 C12	Con la asistencia participativa a las clases expositivas	5
Case study	A7 B1 B5 B8 B11 C2 C3 C9 C13	Realización e discusión dos casos propostos	10
Objective test	A7 A73 B1 B5 B8 B11 C2 C3 C9 C10 C11 C12 C13	Realización de proba individual. A proba obxetiva consistirá nun exame dividido en dúas partes. 1- Parte teórica: 50% da nota final. 2- Parte práctica: 40% da nota final. Para superar a materia, haberá que superar as dúas partes.	85

Assessment comments

The evaluation criteria referred to in Tables A-III/1 and A-III/3 of the STCW Code, and included in the Quality Assurance System, will be taken into account to design and to carry out the evaluation.

GUEST LECTURE: A32, A50, A53, A54, A55, C4, C5

CASE STUDY: A1, A3, A7, A14, A17, A18, A24, A29, A30, A31, A50, B9, B10, B11, C3, A2, A4, A5, A6, A20, A21, A58, B3, B5, B7, B8, C8

OBJECTIVE TEST: B2, B4, C6, C7

Students with recognition of part-time dedication and academic exemption of attendance exemption, according to the "NORM THAT REGULATES THE REGIME OF DEDICATION TO THE STUDY OF GRADUATE STUDENTS IN THE UDC (Arts 2.3, 3.b; 4.3 e 7.5) (04/05/2017):

- Attendance / participation in minimum class activities: 30%.

- Qualification:

a) Elaboration of works: up to 80%

c) Problem solving: up to 80%

b) Written exam on the contents of the subject: up to 100%

d) Other methodologies considered: up to 100%

Sources of information	
Basic	- Çengel-Boles (2003). Termodinámica. Méjico. McGraw-Hill - Claudio Mataix (2000). Turbomáquinas Térmicas . Madrid. Editirial DOSSAT, S.A - F. J. Barclay (1995). Combinned Power and Process-an Exergy Approach . - Frank P. Incropera (1999). Fundamentos de transferencia de calor . Méjico. Prentice Hall - Haywood (2000). Ciclos termodinámicos de potencia y refrigeración . Méjico. Limusa - J. R. Welty (1999). Fundamentos de Tranferencia de Momento, Calor y Masa . Méjico. Limusa - J.L. Gómez Ribelles (2002). Termodinámica Técnica . Valencia. Edit. de la UPV - José Mª. De Juana (2003). Energías Renovables para el desarrollo . Méjico. Thomson-Paraninfo. S.A. - José Mª. Sala Lizarraga (1999). Cogeneración . Bilbao. Servicio Editorial UNIVERSIDAD DEL PAIS VASCO - Juan A. López Sastre (2004). La pila de combustible . Valladolid. Secretariado de Publicaciones e Intercambio. Universidad de Valladolid - M. J. M., and H. N. S. (1995). Fundamentals of Enginnering Thermodynamics . Wiley - M.J. Morán; H.N. Shapiro (2003). Fundamentos de Termodinámica Técnica . Barcelona. Edit. Reverté - Marta Muñoz Domínguez; Antonio José Rovira de Antonio (2006). Ingeniería Térmica . Madrid. UNED - Orosa García, José A. (2008). Termodinámica aplicada con EES . España. Tórculo Edicións - P. Hambling (1991). Turbines, Generators and Associated Plant . Pergamon Press - Robert E. Treybal (1988). Operaciones de transferencia de masa . Méjico. Macgraw-Hill - Santiago Sabulal García (2006). Centrales térmicas de ciclo combinado . España. Ed. Díaz de Santos - J. Carbia; J.A. Orosa (2010). Apuntes de la materia.

Complementary	- A. Bejan (1998). Thermodinamics Optimization of Complex Energy Systems . NATO Sciences - Antonio Creus Solé (2004). Energías Renovables . Barcelona. Edic. Ceysa - Ernest J. Henley (2002). Cálculo de Balances de Materia y Energía . Barcelona. Edit. Reverté. S.A. - H. A. Sorensen (1983). Energy Conversion Systems . Wiley - K. W. Li (1985). Power Plant System Desing . Wiley - Kreit/Bohn (2002). Principios de Transferencia de Calor . Madrid. Thomson - M. Meckler (1994). Retrofitting Buildings for Energy Conservation . The Fairmont Press - Manuel Marquez (2005). Combustión y Quemadores . España. Marcombo - Mario Ortega Rodrígez (1999). Energías Renovables . Madrid. Thomson-Paraninfo - Merle C. Potter y Craig W. Somerton (2004). Termodinámica para Ingenieros . Madrid. McGraw-Hill - Román Monasterio Larrinaga (1993). La Bomba de Calor. Fundamentos, Técnicas y Aplicaciones . Madrid. McGraw-Hill - S. Kabac (1995). Boilers, Evaporators and Condensers . J. Wiley & Sons

Recommendations
Subjects that it is recommended to have taken before
Maritime Installations and Propulsion Systems/631G02354 Thermodynamics and Engineering Thermodynamics/631G02254 Fluid Mechanics/631G02258 Thermal Marine Machinery/631G02361 Auxiliary Equipment for Vessels/631G02362 Electrical Machinery On Board/631G02365
Subjects that are recommended to be taken simultaneously
Oficina Técnica e Proxectos/631G02456
Subjects that continue the syllabus
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.