Teaching Guide				
Identifying Data				2022/23
Subject (*)	Thermal Marine Machinery		Code	631G02361
Study programme	Grao en Tecnoloxías Mariñas			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	1st four-month period	Third	Optional	6
Language	SpanishGalician			
Teaching method	Face-to-face			
Prerequisites				
Department	Ciencias da Navegación e Enxeñaría Mariña			
Coordinador	Arias Fernández, Ignacio	E-mail	ignacio.arias@udc.es	
Lecturers	Arias Fernández, Ignacio	E-mail	ignacio.arias@udc.es	
Web	https://estudos.udc.es/es/subject/631G02V02/631G02361/2021			
General description	Taking into account that this is a core subject, it is intended that the student acquire the necessary and sufficient theoretical and practical knowledge, leading to the attainment of the academic title that he/she intends; and in the exercise of his profession, he/she can solve all the questions that arise in the field of marine thermal engines.			

Study programme competences	
Code	Study programme competences
A1	CE1 - Capacidade para a realización de inspeccións, medicións, valoracións, taxacións, peritacións, estudos, informes, planos de labores e certificacións nas instalacións do ámbito da súa especialidade.
A11	CE11 - Observar prácticas de seguridade no traballo, no ámbito da súa especialidade.
A17	CE17 - Modelizar situacións e resolver problemas con técnicas ou ferramentas físico-matemáticas.
A18	CE18 - Redacción e interpretación de documentación técnica.
A69	CE59 - Manter e reparar os sistemas de control automático da máquina propulsora principal e das máquinas auxiliares
B2	CT2 - Resolver problemas de forma efectiva.
B4	CT4 - Traballar de forma autónoma con iniciativa.
B5	CT5 - Traballar de forma colaboradora.
B10	CT10 - Comunicar por escrito e oralmente os coñecementos procedentes da linguaxe científica.
B11	CT11 - Capacidade para resolver problemas con iniciativa, toma de decisións, creatividade, razoamento crítico e de comunicar e transmitir coñecementos habilidades e destrezas.
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.
C6	C6 - Valorar criticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben enfrontarse.
C8	C8 - Valorar a importancia que ten a investigación, a innovación e o desenvolvemento tecnolóxico no avance socioeconómico e cultural da sociedade.
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
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

Perform energy balances of thermal engines, and make decisions from the point of view of energy optimization.	A1 A11 A17 A18	B2 B4 B5 B10 B11	C3 C6 C8 C10 C12 C13
Operation, repair and maintenance of thermal engines, and auxiliary equipment thereof.	A1 A11 A18	B2 B11	C3 C6 C10 C12
Calculation of the components that intervene in the installations of the thermal engines.	A1 A17	B2 B11	C3 C8
Supervision, interpretation and diagnosis of the variables that intervene in the operation of thermal engines.	A1 A18 A69	B2 B11	C3 C6 C8 C13

Contents	
Topic	**Sub-topic**
1. Fundamentals of Heat Engines	- Clasificación - Evolución cronolóxica - Campos e aplicacións de máquinas térmicas - Máquinas reversibles
2. Environmental impact of heat engines	- Fontes de contaminación nos motores - Análise dos gases de escape - Control de emisións - Sistemas anticontaminación en motores alternativos
3. Instrumentation in heat engines	- Xeneralidades - Transmisores - Medicións de presión, caudal, nivel e temperatura - Outras variables - Regulación automática - Calibración do instrumento
4. Steam turbines for power generation	- Fundamentos - Ciclos teóricos e reais - Clasificación - Compoñentes: pezas fixas e móbiles
5. Alternative internal combustion engines	- Introdución - Ciclos termodinámicos - Curvas características - Cámaras de combustión - Refrixeración dos álabes - Componentes das turbinas de gas - Aplicacións
6. Industrial gas turbines	- Introdución - Principais características. - Relicación a bordo de buques GLP - Relicación a bordo de buques GNL

7. Combined cycles.	- Introducción - Tipos de ciclos combinados - Ciclos combinados con varios niveis de presió - Caldeiras de recuperación - Parámetros principais - Rendementos
8. On-board refrigeration system	- Introdución. - Uso do frío: sectores e aplicación a bordo de buques - Cálculo de cargas térmicas - Estudo de diferentes tipos de instalacións
9. LNG/LPG Ships	.

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Objective test	A11 A17 B2 B4 B10 C3 C10 C12	4	0	4
Case study	A1 B5 B11	7	28	35
Problem solving	A11 B4 C3 C10	14	49	63
Guest lecture / keynote speech	A1 A18 A69 C6 C8 C13	21	21	42
Personalized attention		6	0	6
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	Description
Objective test	Written tests will be carried out, consisting of theoretical and practical questions.
Case study	Real case studies related to the processes object of the subject to study will be carried out. There will be a sharing of the studies carried out and the discussion of the different solutions adopted to the determined problem.
Problem solving	They will propose and solve a series of problems referred to the contents of the subject matter, and oriented as far as possible to real cases.
Guest lecture / keynote speech	The detailed explanation of the contents of the subject distributed in subjects will be made. The student will have bibliographical material of support of the subject in each master session. The participation of the student in class will be encouraged, through comments that bring to relate the eoric contents with the real experience.

Personalized attention	
Methodologies	Description
Objective test Problem solving Case study Guest lecture / keynote speech	It is about guiding the student in the custiones related to the subject taught and that they are especially difficult to understand and apply to practical cases. Also included are exam reviews. The communication channels will be through the Moodle, email and individualized tutorials that will be developed during the scheduled time for each academic year.

Assessment			
Methodologies	Competencies	Description	**Qualification**
Objective test	A11 A17 B2 B4 B10 C3 C10 C12	The degree of knowledge acquired on the subject will be assessed, both in the theoretical part and in the practical knowledge.	70
Problem solving	A11 B4 C3 C10	Participation in problem solving will be valued, as well as the presentation of the results thereof.	15

Case study	A1 B5 B11	The solutions provided to the study of proposed cases, the originality of the same, and their exposure and defense will be evaluated.	15

Assessment comments
The evaluation criteria contemplated in table A-III / 2 of the STCW Code, and included in the quality assurance system, will be taken into account when designing and carrying out the evaluation. The students with recognition of part-time dedication or academic exemption "NORM THAT REGULATES THE RATE OF DEDICATION OF THE STUDY OF DEGREE STUDENTS AT THE UDC (Arts. 2.3; 3.b; 4.3 and 7.5) (04/05/2017): Supervised projects account for 30 % of the total mark Objective test accounts for 70 % of the total mark *Evaluation observations: The same requirements are maintained in the 2nd evaluation computing attendance both, personal and on-line if applicable (according to the attendee list downloaded from Teams). For students with recognition of part-time dedication and academic exemption from attendance exemption, the grade obtained in the activities associated with the personalized tutoring system will correspond to the evaluation of the supervised projects methodology and objective tests, with a weighting of 30 and 70%, respectively .

Sources of information	
Basic	- R. W. Haywood (2000). Ciclos termodinámicos de potencia y refrigeración. México. Ed. LIMUSA, S.A - Claudio Mataix (2000). Turbomáquinas Térmicas. Madrid. DOSSAT - Manuel Muñoz Torralbo (2001). Turbomáquinas Térmicas. Madrid. Sec. public. ETS Ingenieros Industriale - Santiago Sabugal García (2006). Centrales Térmicas de Ciclo Combinado. Ed. Díaz de Santos - Rolf Kehlofer (2009). Combined-Cycle Gas & Steam Turbine Power Plants. Tulsa, Oklahoma. PennWell - José M. Sala Lizarraga (1999). Cogeneración. Bilbao. Servic. Edit. de la Unuversidad del Pais Vasco - Mariano Muñoz Rodríguez (1999). Turbomáquinas Térmicas. Zaragoza. Ed. PRENSAS UNIVERSITARIAS DE ZARAGOZA - Consuelo Sánchez Naranjo (2010). Tecnología de las centrales termoeléctricas convencionales. Madrid. Librería UNED - J. H. Horlock (2002). Combiner Power Plants. Malabar, Florida. Krieger Publishing Company
Complementary	- Mario Villares Martín (2003). Cogeneración. Madrid. Fundación Confemetal

Recommendations
Subjects that it is recommended to have taken before
Maritime Installations and Propulsion Systems/631G02354 Thermodynamics and Engineering Thermodynamics/631G02254 Internal Combustion Engines/631G02351 Steam and Gas Turbines/631G02352 Heat transfer and steam generators/631G02353
Subjects that are recommended to be taken simultaneously
Maritime Installations II/631G02359
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.