Teaching Guide				
Identifying Data				2023/24
Subject (*)	Power Stations		Code	770G02024
Study programme	Grao en Enxeñaría Eléctrica			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	1st four-month period	Third	Obligatory	6
Language	SpanishGalician			
Teaching method	Face-to-face			
Prerequisites				
Department	Enxeñaría Industrial			
Coordinador	Casteleiro Roca, José Luis	E-mail	jose.luis.casteleiro@udc.es	
Lecturers	Casteleiro Roca, José Luis	E-mail	jose.luis.casteleiro@udc.es	
Web				
General description	This course aims to give the student the theoretical knowledge of the different types of Power Generation Plants, as well as their operation. The aim is to achieve the necessary knowledge for its operation, analysis and design.			

Study programme competences / results	
Code	Study programme competences / results
A1	Capacidade para a redacción, firma, desenvolvemento e dirección de proxectos no ámbito da enxeñaría industrial, e en concreto da especialidade de electricidade.
A4	Capacidade de xestión da información, manexo e aplicación das especificacións técnicas e da lexislación necesarias no exercicio da profesión.
A5	Capacidade para analizar e valorar o impacto social e medioambiental das solucións técnicas actuando con ética, responsabilidade profesional e compromiso social, e buscando sempre a calidade e mellora continua.
A32	Capacidade para o deseño de centrais eléctricas.
B1	Capacidade de resolver problemas con iniciativa, toma de decisións, creatividade e razoamento crítico.
B2	Capacidade de comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial.
B4	Capacidade de traballar e aprender de forma autónoma e con iniciativa.
B5	Capacidade para empregar as técnicas, habilidades e ferramentas da enxeñaría necesarias para a práctica desta.
B9	CB2 - Que los estudiantes sepan aplicar sus conocimientos a su trabajo o vocación de una forma profesional y posean las competencias que suelen demostrarse por medio de la elaboración y defensa de argumentos y la resolución de problemas dentro de su área de estudio.
C6	Valorar criticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben enfrontarse.

Learning outcomes			
Learning outcomes	Study programme competences / results		
Knowing the different energy systems that can be used in power stations	A4	B1	
Understanding the processes of power generation from traditional energy sources	A1 A5	B4	C6
Knowing the selection and resize of the elements of the generation system of the power stations	A4	B9	
Knowing the selection and resize of the auxiliary systems of the power stations	A5 A32	B1 B5	C6
Knowing the principles of operation of the electricity market	A4	B2	
Knowing the principles of operation of energy markets	A4	B2	

Contents	
Topic	Sub-topic

The contents described in the verification memory are developed below according to the distribution shown	Electric generation systems. (Topic 1) Classic power stations: Components. Alternators Command, regulation, control and auxiliary services. Transformation parks. (Topics 3, 4, 5 and 7) Other electric generation facilities. (Topics 6 and 8) Introduction to the generation operation and the electricity markets. (Topic 2)
Topic 1: Electric energy and sustainable development - Environmental impact and more efficient technologies electricity production	1.1. Introduction to sustainable development 1.2. CO2 emission costs 1.3. Combustion processes 1.4. Environmental impact of different technologies 1.5. Techniques improved efficiency 1.6. New technologies of coal use 1.7. Technology coal gasification 1.8. CO2 capture and storage
Topic 2: Energy resources and electricity production - Coverage of the electricity demand	2.1. Reservations and energy resources 2.2. Classification and types of power plants 2.3. Study of different types of primary energy sources 2.4. Study of the electricity demand 2.5. Power System configuration 2.6. Configuration and operation of the Spanish electricity market 2.7. Rates, prices and costs of electricity 2.8. Generation scheduling 2.9. Parameters related to production
Topic 3: Coal power plants	3.1. Water-steam circuit. Steam turbines 3.2. Air-gas circuit 3.3. Fuel-ash circuit 3.4. Cooling water circuit 3.5. Regulation of the power station

Topic 4: Nuclear power plants	4.1. Nuclear fission 4.2. Elements of a nuclear reactor 4.3. Nuclear reactor control 4.4. Types of nuclear reactors
Topic 5: Wiring diagrams. Auxiliary services	5.1. Study of different electrical diagrams 5.2. Auxiliary services of the power stations. Energy consumption 5.3. Reserve supply
Topic 6: Gas power plants. Combined cycle. cogeneration	6.1. Brayton thermodynamic cycle 6.2. Gas turbines. Components 6.3. Otto-Diesel thermodynamic cycle 6.4. Internal combustion engines 6.5. Combined cycle. Heat Recovery Steam Generator 6.6. Regulation and control of a combined cycle 6.7. Cogeneration
Topic 7: Conventional and pumping hydroelectric plants	7.1. Description of the components of a hydroelectric plant 7.2. Hydraulic turbines. Control and regulation 7.3. Reversible hydroelectric power plants. Types
Topic 8: Introduction to power plants with renewable sources	Wind, thermal, photovoltaic, biomass, marine, geothermal and mini hydro power stations

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A1 A4 A5 A32 B2 B4	21	38	59
Problem solving	A4 A32 B1 B5 C6	21	30	51
Supervised projects	A4 A32 B1 B2 B4 B9 C6	5	25	30
Field trip	A32 B2	4	0	4
Mixed objective/subjective test	A4 A5 A32 B1 B5	4	0	4
Personalized attention		2	0	2
(*)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	Keynote speech complemented with the use of audiovisual media and the introduction of some questions to students, in order to transmit knowledge and facilitate learning. The order of the topics covered will not have to be the one described in the teaching guide. In addition, there will be topics that can be seen together on the development of others, and the division between them may not be strict.
Problem solving	Solving exercises and specific problems in the classroom, from the knowledge explained.
Supervised projects	Performing a bulletin individual character problems, similar to those solved in the classroom exercises. In addition, within the supervised projects can include a small work of specific subjects of the assignment to ensure the correct understanding of the subject.
Field trip	Visit to an industrial facility related to the content of the subject.
Mixed objective/subjective test	It consists in carrying out an test of approximately 4 hours, in which the acquired knowledge will be evaluated.

Personalized attention	
Methodologies	**Description**
Supervised projects	The student has the relevant meetings of personalized tutorials, to resolve the concerns arising from the matter. The realization of the problems set is individual, and each student may attend the tutoring sessions it deems appropriate to resolve the doubts that arise.

Assessment			
Methodologies	**Competencies / Results**	**Description**	**Qualification**
Problem solving	A4 A32 B1 B5 C6	Resolution of a practical case.	15
Mixed objective/subjective test	A4 A5 A32 B1 B5	Exam with part of multiple choice, development questions and exercises.	70
Supervised projects	A4 A32 B1 B2 B4 B9 C6	Some tasks established in the subject, within the framework of this methodology.	15

Assessment comments
As part of the "Supervised projects" may include aspects such as attendance, personal work, proposed personal work, attitude, etc., to help to pass the subject. The "Mixed test" will be divided into a theoretical (multiple choice) (70%), short questions (20%) and exercices part (10%). The grade obtained by the student with the "Supervised projects" will be weighted with the mark obtained in the exercices of the "Mixed test". It is necessary to exceed 50% of the score in the multiple choice part of the "Mixed test" to pass the subject. The students, that don't pass the "Supervised projects", have to pass sxercices with more sections in the "Mixed test". Students with recognition of part-time dedication and academic waiver of attendance exemption, second establishes the "NORMA QUE REGULA O RÉXIME DE DEDICACIÓN AO ESTUDO DOS ESTUDANTES DE GRAO NA UDC (Arts. 2.3; 3.b e 4.5) (29/5/212)", will be evaluated in the same way, allowing one more week of margin in the assignments. For the second opportunity, there will be no second deadline for assignments, and the evaluation of "Supervised projects" will be included in the "Mixed test". The evaluation criteria of the early December call will be the same as those of the second opportunity of the previous year. The fraudulent completion of tests or assessment activities, once verified, will directly imply that the student will be qualified with "suspension" (numerical grade 0) in the corresponding call for the academic year, whether the offense is committed at the first opportunity as in the second For this, your qualification will be modified in the first opportunity report, if necessary. In case the student commits an infraction in the subject (according to the Student Disciplinary Regulations): the student will be graded with a "fail" (numerical grade 0) in the corresponding exam session, whether the infraction is committed at the first or second opportunity. For this, the student's grade will be modified in the first opportunity report, if necessary.

Sources of information	
Basic	- Sanz Feito, J. (1990). Centrales Eléctricas. UPM - Orille Fernández, Á. L. (1993). Centrales Eléctricas I, II y III. UPC - Barrero, F. (2004). Sistemas de energía eléctrica. Thomson - Sabugal García, S. (2006). Centrales térmicas de ciclo combinado: teoría y proyecto. Díaz de Santos - Rojas Rodríguez, S. (1997). Centrales hidroeléctricas teoría y problemas. UNEX
Complementary	- Gómez Expósito, A. (2003). Sistemas eléctricos de potencia problemas y ejercicios resueltos. Prentice Hall - Lapuerta Amigo, M. (1998). Tecnologías de la combustión. Universidad de Castilla-La Mancha - García Ybarra, P. L. (2001). Tecnologías energéticas e impacto ambiental. McGraw-Hill

Recommendations
Subjects that it is recommended to have taken before
Termodinámica/770G02012 Mecánica de Fluídos/770G02016
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
Installations of Renewable Energies/770G02033 Acquisition techniques of electrical measurements/770G02030 Efficient management of electric power/770G02040 Industrial Mantenience/770G02041 Industrial Instrumentation/770G02042 Industrial Communications/770G02043
Other comments
Recommendations on sustainability and the environmentStudents will be taught the importance of ethical principles related to the values of sustainability so that they can apply them not only in the classroom, but also in their personal and professional behaviour.To help achieve an immediate sustainable environment and meet the objective of action number 5: "Healthy, environmentally and socially sustainable teaching and research" of the "Green Campus Ferrol Action Plan":The delivery of the documentary work carried out in this subject:- It will be requested in digital format and/or in computer support.- It will be done through Moodle, in digital format without the need to print it.- If it is necessary to do them on paper: o No plastics will be used. o Double-sided printing will be used. o Recycled paper should be used. o Drafts should not be printed.Sustainable use of resources and prevention of negative impacts on the natural environment should be made.Recommendations on Gender Equality and respect for diversity- According to the different regulations applicable to university teaching, the gender perspective must be incorporated in this subject (non-sexist language will be used, bibliography of authors of both sexes will be used, the intervention of male and female students in class will be encouraged...).- We will work to identify and modify sexist prejudices and attitudes, and we will influence the environment to modify them and promote values of respect and equality.- Situations of gender discrimination will be detected and actions and measures to correct them will be proposed.- The full integration of students who, for physical, sensory, mental or socio-cultural reasons, experience difficulties in gaining suitable, equal and beneficial access to university life will be facilitated.