Teaching Guide				
Identifying Data				2024/25
Subject (*)	Electrical Systems of Marine Propulsion		Code	631480103
Study programme	Mestrado Universitario en Enxeñaría Mariña			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	1st four-month period	First	Obligatory	6
Language	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	Enxeñaría Industrial			
Coordinador	Masdias y Bonome, Antonio	E-mail	antonio.masdias@udc.es	
Lecturers	Masdias y Bonome, Antonio	E-mail	antonio.masdias@udc.es	
Web				
General description	O obxectivo é impartir formación de posgrao a estudantes que xa teñen coñecemento xeral das máquinas eléctricas empregadas a bordo e cada vez máis empregadas na propulsión, así como das instalacións eléctricas asociadas, integrando estes coñecementos e centrándoos na xestión.			

Study programme competences / results	
Code	Study programme competences / results
A2	Detectar e definir a causa dos defectos de funcionamento das máquinas e reparalas, a nivel de xestión.
A5	Garantir que se observan as prácticas de seguridade no traballo, a nivel de xestión.
A6	Facer arrancar e parar a máquina propulsora principal e a maquinaria auxiliar, incluídos os sistemas correspondentes, a nivel de xestión.
A7	Facer funcionar o equipo eléctrico e electrónico, a nivel de xestión.
A9	Manter a seguridade dos equipos, sistemas e servizos da maquinaria, a nivel de xestión.
A13	Planificar e programar as operacións, a nivel de xestión.
A14	Probar o equipo eléctrico e electrónico, detectar avarías e mantelo en condicións de funcionamento o reparalo, a nivel de xestión.
B2	Resolver problemas de forma efectiva.
B4	Traballar de forma autónoma con iniciativa.
B5	Traballar de forma colaborativa.
B7	Capacidade para interpretar, seleccionar e valorar conceptos adquiridos noutras disciplinas do ámbito marítimo, mediante fundamentos físico-matemáticos.
B9	Capacidade para a aprendizaxe de novos métodos e teorías, que lle doten dunha gran versatilidade para adaptarse a novas situacións.
B12	Posuír e comprender coñecementos que aporten unha base ou oportunidade de ser orixinais no desenvolvemento e/ou aplicación de ideas, a miúdo nun contexto de investigación
B13	Que os estudantes saiban aplicar os coñecementos adquiridos e a sua capacidade de resolución de problemas en contornas novas ou pouco coñecidas dentro de contextos máis amplos (ou multidisciplinares) relacionados coa súa área de estudo
B14	Que os estudantes sexan capaces de integrar coñecementos e enfrontarse á complexidade de formular xuízos a partires dunha información que, sendo incompleta ou limitada, inclúa reflexións sobre as responsabilidades sociais e éticas vencelladas á aplicación dos seus coñecementos e xuízos
B15	Que os estudantes saiban comunicar as súas conclusións e os coñecementos e razóns últimas que as sustentan a públicos especializados e non especializados dun xeito claro e sin ambigüidades
B16	Que os estudantes posúan as habilidades de aprendizaxe que lles permitan continuar estudando dun xeito que haberá de ser en grande medida autodirixido ou autónomo.
C1	Expresarse correctamente, tanto de forma oral coma escrita, nas linguas oficiais da comunidade autónoma.
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	Valorar criticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben enfrontarse.
C8	Valorar a importancia que ten a investigación, a innovación e o desenvolvemento tecnolóxico no avance socioeconómico e cultural da sociedade.

C9	Falar ben en público

Learning outcomes			
Learning outcomes	Study programme competences / results		
Management of maintenance and repair of electrical machines.	AC2	BC2	CC1
Management of the operation of the main and auxiliary machinery	AC5	BC4	CC3
Test management, fault detection, repair and maintenance of electrical equipment.	AC6	BC5	CC6
Management of safety practices at work.	AC7	BC7	CC8
Management of electronic power devices	AC9	BC9	CC9
Detect and define the cause of the malfunctions of the machines and repair them, at the management level.	AC13	BC12	
Ensure that occupational safety practices are observed at the management level.	AC14	BC13	
Start and stop the main propulsion machinery and the auxiliary machinery, including the corresponding systems, at the management level.		BC14 BC15	
Operate electrical and electronic equipment, at the management level.		BC16	
Operate the machine, control, monitor and evaluate its performance and capacity, at the management level.			

Contents	
Topic	Sub-topic
INTRODUCTION TO ELECTRIC PROPULSION	- Management function in a naval electric propulsion plant. - Selection of solid state components according to ease of command, switching speed and power range. - Analysis of the types of naval installations of electric propulsion. Evolution. Current facilities in use. New constructions. -Azimuth thrusters. Characteristics. Analysis of the different types by their drive motor and power range. - Study of power plant alternatives. Technical, economic and operational implications. Current trends depending on the type of ship. - High Tension in propulsion and distribution. - Management of a naval propulsion power plant.
ELECTRICAL INSTALLATIONS	- Interpretation of technical documentation on electrical machines and systems. - Calculation of lines and protections. - Naval electric propulsion type plants. - PODs - Technical-economic justification. Fields of application. - New designs. - Management of a naval propulsion power plant. - Power Management System.
POWER ELECTRONICS AND ELECTRICAL MACHINES	- Power electronic devices, power control circuits, rectifier circuits and converters. Applications. - Assembly, testing, maintenance and repair of electrical machines and electrical installations. - Marine electrotechnology, electronics, power electronics, automatic control machines and control devices safety - Direct and indirect electrical energy converters. - Power electronic components. - Project characteristics of high voltage installations. - Pieces of Respect

ELECTRICAL HAZARDS	Prevention of occupational hazards and environmental protection. Risks evaluation.

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
ICT practicals	A2 B4 C3	5	1	6
Laboratory practice	A6 A7 A9 A13 A14 B5 B7 B12 B13 B14 B15 B16 C1 C9	4	1	5
Problem solving	B9 C6	4	1	5
Directed discussion	A5 B2 B5 B7 C8	2	0	2
Oral presentation	A2 A5 B5	97	1	98
Objective test	B2 C3 C6	2	1	3
Workbook	A5	1	1	2
Document analysis	C8	4	1	5
Seminar	B9 C3 C8	21	1	22
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
ICT practicals	De acuerdo con el interés individual o del grupo
Laboratory practice	Complementarias a los realizadas en los cursos anteriores
Problem solving	Resolución razonada a los problemas propustos
Directed discussion	Ante cuestiones planteadas, discusión de las distintas alternativas.
Oral presentation	Exposición de los conceptos teóricos
Objective test	acorde a los conceptos a desarrollar
Workbook	De la amplia bibliografía proporcionada
Document analysis	De acuerdo con el contenido
Seminar	Incidiendo en aspectos de interés particular

Personalized attention	
Methodologies	Description
Seminar ICT practicals Laboratory practice Problem solving Directed discussion Oral presentation Objective test Workbook	Practices with electrical panels that implement the assembly of circuits after the design. After the delivery of the bulletins of the problem, giving time to the resolution on the part of the students, they will be solved in the classroom, clarifying the doubts. Directed discussion seeks to raise issues whose solution involves knowledge of the topic discussed above. The oral presentation will consist of the explanatory development of the subjects of the subject, by the teacher, using various educational resources. The objective test will usually include the development of theoretical questions, problems, and the elaboration of electrical diagrams. The reading will be about technical articles in English on the content of the subject. The seminars will be held with small groups that will address a topic and encourage participation and group work.

Assessment			
Methodologies	Competencies / Results	Description	**Qualification**
Seminar	B9 C3 C8	Seminario Incidiendo en aspectos de interés particular	5

ICT practicals	A2 B4 C3	Prácticas a través de TIC De acuerdo con el interés individual o del grupo	10
Laboratory practice	A6 A7 A9 A13 A14 B5 B7 B12 B13 B14 B15 B16 C1 C9	Prácticas de laboratorio Complementarias a los realizadas en los cursos anteriores	5
Problem solving	B9 C6	Solución de problemas Resolución razonada a los problemas propuestos	5
Directed discussion	A5 B2 B5 B7 C8	Discusión dirixida Ante cuestiones planteadas, discusión de las distintas alternativas.	5
Oral presentation	A2 A5 B5	Presentación oral: Exposición de los conceptos teóricos	5
Objective test	B2 C3 C6	Proba obxectiva : acorde a los conceptos a desarrollar	60
Workbook	A5	Lecturas De la amplia bibliografía proporcionada	5

Assessment comments
The percentages are only a first approximation. The evaluation criteria set out in Table A-III / 2 of the STCW Code and included in the Quality Assurance System will be taken into account when designing and conducting the evaluation. The assessment is to verify the specific competencies A2-A5-A6-A7-A14 and the transversal type B: B2-B4-B5 The evaluation criteria set out in Tables A-III / 1 and A-III / 3 of the STCW, and included in the quality assurance system, are taken into account so that students with recognition of part-time dedication and academic exemption exemption from attendance , as established by the "RULE THAT REGULATES OR RULES OF DEDICATION TO STUDY TWO UNDERGRADUATE STUDENTS IN THE UDC (Art. 2.3; 3. b; 4.3 and 7.5) (05/04/2017): possibility to get a 100% grade. The student is reminded of the importance of deadlines when submitting work, as well as the importance of complying with the rules and regulations of the UDC, and referencing all documentation and content not prepared by the student. Specifically, the fraudulent performance of the tests or evaluation activities, once verified, will directly imply the qualification of failing "0" in the subject, in the corresponding call, thus invalidating any qualification obtained in all the evaluation activities for the extraordinary summons

Sources of information	
Basic	- Alf Kare Adnanes (2003). Maritime Electrical Installations and Diesel Electric Propulsion. Oslo. ABB AS Marine - Damir Radan (). Power Electronic Converters for ships propulsion electric motors. - Faure Benito, Roberto (2000). Máquinas y accionamientos eléctricos. Madrid. FEIN - Borrás Formoso (2011). Apuntes de Propulsión eléctrica naval. - Lena Bergh (2007). Electrical systems in pod propulsion. Goteborg-Chalmers University - AENOR (). UNE21-135-501.Instalaciones Eléctricas en Buques.Planta de propulsión Eléctrica. Madrid - Fraile Mora, J. (2008). Máquinas eléctricas. 6a ed. Madrid: McGraw-Hill, 2008.. Madrid: McGraw-Hill Se proyectarán los videos elaborados por "Videotel Marine International" relacionados con el contenido de la materia.Se subirán a Moodle los contenidos complementarios necesarios para el correcto seguimiento de la asignatura
Complementary	- Lena Bergh (2007). Electrical systems in pod propulsion. Goteborg. Suecia. Chalmers University of Tecnology - Bobby A. Bassham (2003). Evaluation of electric motors for ship propulsion. Monterey.California.Naval Postgraduate School.

Recommendations
Subjects that it is recommended to have taken before

Electrotechnology, Electrical Machinery and Electronic Systems for Vessels/631G02253 /
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
Other comments
Complemento a las asignaturas previamente cursadas Sería conveniente tener conocimientos de la hoja de cálculo Excel. Se propondrá la elaboración de una aplicación simulando la evolución de parámetros según distintos modos de operación de una planta de propulsión eléctrica naval.