Teaching Guide				
Identifying Data				2022/23
Subject (*)	Electricity and Electronics		Code	631G01206
Study programme	Grao en Náutica e Transporte Marítimo			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	1st four-month period	Second	Obligatory	6
Language	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	Enxeñaría de Computadores			
Coordinador	Bregains Rodriguez, Julio Claudio	E-mail	julio.bregains@udc.es	
Lecturers	Andión Fernández, José Manuel Bregains Rodriguez, Julio Claudio	E-mail	jose.manuel.andion@udc.es julio.bregains@udc.es	
Web	campusvirtual.udc.es			
General description	In this course the student will acquire the basic knowledge of components and circuits that constitute the electrical and electronic systems of the ship. This knowledge will allow them to evaluate the operation of the power, control and communication systems of the ships, as well as to acquire critical judgment to detect failures and solve them.			

Study programme competences	
Code	Study programme competences
A6	Localizar avarías sistematicamente nun equipo electrónico.
A8	Modelizar situacións e resolver problemas con técnicas ou ferramentas físico-matemáticas.
A9	Avaliación cualitativa e cuantitativa de datos e resultados, así como representación e interpretación matemática de resultados obtidos experimentalmente.
A10	Redactar e interpretar documentación técnica e publicacións náuticas.
B2	Resolver problemas de xeito efectivo.
B5	Traballar de forma autónoma con iniciativa.
B6	Traballar de forma colaboradora.
B8	Aprender en ámbitos de teleformación.
B10	Versatilidade.
B11	Capacidade de adaptación a novas situacións.
B12	Uso das novas tecnoloxías TIC, e de Internet como medio de comunicación e como fonte de información.
B13	Comunicar por escrito e oralmente os coñecementos procedentes da linguaxe científica.
B14	Capacidade de análise e síntese.
B15	Capacidade para adquirir e aplicar coñecementos.
B16	Organizar, planificar e resolver problemas.
B19	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.
B22	Valorar criticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben enfrontarse.
C10	Que os estudantes saiban aplicar os coñecementos adquiridos e a súa capacidade de resolución de problemas en contornas novas ou pouco coñecidas dentro de contextos máis amplas (ou multidisciplinares) relacionados coa súa área de estudo
C13	Que os estudantes posúan as habilidades de aprendizaxe que lles permitan continuar estudando dun modo que haberá de ser en grande medida autodirixido ou autónomo.

Learning outcomes	
Learning outcomes	Study programme competences

Be able to interpret electrical diagrams.	A6 A8 A9 A10	B2 B5 B6 B8 B10 B11 B12 B13 B14 B15 B16 B19 B22	C10 C13
Be able to analyze electrical installations.	A6 A8 A9 A10	B2 B5 B6 B8 B10 B11 B12 B13 B14 B15 B16 B19 B22	C10 C13
Practical applications of analog and digital integrated circuits, and solid state devices.	A6 A8 A9 A10	B2 B5 B6 B8 B10 B11 B12 B13 B14 B15 B16 B19 B22	C10 C13

Know the electrical alternators.	A6 A8 A9 A10	B2 B5 B6 B8 B10 B11 B12 B13 B14 B15 B16 B19 B22	C10 C13
Evaluate powers.	A6 A8 A9 A10	B2 B5 B6 B8 B10 B11 B12 B13 B14 B15 B16 B19 B22	C10 C13
Know the operation of electronic instrumentation.	A6 A8 A9 A10	B2 B5 B6 B8 B10 B11 B12 B13 B14 B15 B16 B19 B22	C10 C13

Knowledge of the characteristics of basic semiconductor devices	A6 A8 A9 A10	B2 B5 B6 B8 B10 B11 B12 B13 B14 B15 B16 B19 B22	C10 C13

Contents	
Topic	**Sub-topic**
CHAPTER 1: INTRODUCTION. DIRECT CURRENT CIRCUITS.	1.1. The atom. Electric charge and force. Electrical conductors and insulators. 1.2. Mechanical and electrical quantities: work, energy, voltage, current, power. 1.3. Electrical resistance. Ideal sources. 1.4. Ohm's law. Joule's law. Series and parallel circuits. Kirchhoff's Laws. 1.5. Real sources. Circuit theorems: Thévenin, Norton. 1.6. Circuit analysis.
CHAPTER 2: ALTERNATING CURRENT CIRCUITS. TRANSFORMERS.	2.1. Time-dependent functions. Fundamental values. 2.2. Sine regime, and behavior of R, L and C. 2.3. Impedance and admittance. Resonance. 2.4. The ideal transformer. 2.5. Circuit theorems: Thévenin, Norton. 2.6. Circuits analysis. 2.7. General information about electrical safety.
CHAPTER 3: MANOEUVRING AND CIRCUIT BREAKERS. GENERATION AND DISTRIBUTION OF ENERGY. ELECTROMECHANICAL SYSTEMS.	3.1. Fundamentals of three-phase systems 3.2. Control and protection elements for installations. 3.3. Fundamentals of generators and motors. 3.4. Electric propulsion for ships. 3.5. Analysis of circuits and drawings of installations.
CHAPTER 4: SEMICONDUCTORS. DIODES. APPLICATIONS.	4.1. Fundamentals: intrinsic and extrinsic semiconductor 4.2. Currents in a semiconductor. Polarized PN junction. 4.3. Basic structure and operation of PN diodes and LEDs. 4.4. Diode equivalent models. 4.5. Applications. Rectifier circuits. 4.6. Other diodes.
CHAPTER 5: BIPOLAR JUNCTION TRANSISTOR.	5.1. Basic structure and operation of a bipolar transistor 5.2. Circuit analysis in common emitter configuration. 5.3. Input and output characteristics. 5.4. Switching circuits.
CHAPTER 6: UNIPOLAR MOSFET TRANSISTOR.	6.1. Basic structure and operation of a MOSFET. 6.2. Circuit analysis in common source configuration. 6.3. Input and output characteristics. 6.4. Switching circuits.

CHAPTER 7: AMPLIFIERS GENERAL CONCEPTS. THE OPERATIONAL AMPLIFIER.	7.1. Characteristics of the amplifiers. 7.2. Concept of negative feedback. 7.3. The operational amplifier. Linear and non-linear applications. 7.4. Circuit analysis.
CHAPTER 8: DIGITAL CIRCUITS. APPLICATIONS.	8.1. Fundamentals of digital circuits. 8.2. Analogical-digital conversion. 8.3. Applications.
PROBLEM SOLVING SESSIONS.	Problem sessions corresponding to the theory content, with the exception of chapter 5 (bipolar junction transistor).
LABORATORY PRACTICES.	PRACTICE 1: EQUIPMENT HANDLING (I). 1.1. Feeding source and multimeter. 1.2. Measurement of resistances. 1.3. Measurement of DC voltages and currents with multimeter. PRACTICE 2: EQUIPMENT HANDLING (II). 2.1. Signals generator and oscilloscope. 2.2. Measurement of AC voltages with multimeter and oscilloscope.
ICT PRACTICES.	Circuit design and measurement practices will be carried out with the LTSpice software according to the theory syllabus.
O desenvolvemento e superación destes contidos, xunto cos correspondentes a outras materias que inclúan a adquisición de competencias específicas da titulación, garanten o coñecemento, comprensión e suficiencia das competencias recollidas no cadro AII/2, do Convenio STCW, relacionadas co nivel de xestión de Primeiro Oficial de Ponte da Mariña Mercante, sen limitación de arqueo bruto e Capitán da Mariña Mercante ata o máximo de 3000 GT.Cadro A-II/2 do Convenio STCW.	Especificación das normas mínimas de competencia aplicables a Capitáns e primeiros oficiais de ponte de buques de arqueo bruto igual ou superior a 500 GT.

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A6 A8 A9 A10 B2 B5 B6 B8 B10 B11 B12 B13 B14 B15 B16 B19 B22 C10 C13	30	39	69
Problem solving	A8 A9 B2 B5 B6 B10 B11 B12 B14 B15 B16 B19 B22	8	28	36
Mixed objective/subjective test	A6 A8 A9 A10 B2 B5 B6 B8 B10 B11 B12 B13 B14 B15 B16 B19 B22 C10 C13	3	0	3
Laboratory practice	A6 A8 A9 A10 B2 B5 B6 B8 B10 B11 B12 B13 B14 B15 B16 B19 B22 C10 C13	8	12	20

ICT practicals	A6 A8 A9 A10 B2 B5 B6 B8 B10 B11 B12 B13 B14 B15 B16 B19 B22 C10 C13	8	12	20
Short answer questions	A6 A8 A9 A10 B2 B5 B6 B8 B10 B11 B12 B13 B14 B15 B16 B19 B22 C10 C13	1	0	1
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**
Guest lecture / keynote speech	Didactic exposition -using slides and/or blackboard- of the theoretical contents of the subject.
Problem solving	Statement and solving of problems related to the contents of the course, using slides and/or blackboard.
Mixed objective/subjective test	Exam on theory and problem solving about the contents exposed during the lectures and problem solving sessions throughout the course.
Laboratory practice	The students will develop a series of practices in the Electronics Laboratory, about measurement equipment and components. Along with these practices, the students will have to answer a set of questions related to the topics to be developed in those practices.
ICT practicals	The students will develop a series of practical exercises on PC using electronic circuit simulation software. Along with these practices, the students will have to answer a set of questions related to the topics to be developed in those practices.
Short answer questions	Students will be required to answer a set of questions related to the topics to be developed in each practice session.

Personalized attention	
Methodologies	**Description**
Laboratory practice Guest lecture / keynote speech ICT practicals Problem solving	Lecture session: Attending and solving student's doubts related to the theoretical material presented in the lecture sessions. Problem solving: Attending and solving the student's doubts related to the problems presented in class. Laboratory practices: Attending and solving student's doubts related to the practices proposed or carried out in the laboratory. Practices through ICT: Attending and solving student's doubts related to the practices proposed or carried out through ICT. Personalized attention: In relation to the theory and problem solving classes, individualized tutoring hours will be preferably used. Tutorials may be face-to-face or telematic (via Teams). In relation to the practical classes, individualized tutoring hours will be preferably used, being also possible the use of e-mail. Tutorials may be face-to-face or telematic (via Teams).

Assessment			
Methodologies	**Competencies**	**Description**	**Qualification**

Laboratory practice	A6 A8 A9 A10 B2 B5 B6 B8 B10 B11 B12 B13 B14 B15 B16 B19 B22 C10 C13	The work done by the student in each of the sessions will be evaluated. Students with part-time dedication or with academic waiver from teaching exemption will have the option of taking a laboratory practice test at the end of the course.	4
ICT practicals	A6 A8 A9 A10 B2 B5 B6 B8 B10 B11 B12 B13 B14 B15 B16 B19 B22 C10 C13	The work done by the student in each of the sessions will be evaluated. Students with part-time dedication or with academic waiver from teaching exemption will have the option of taking an ICT practice test at the end of the course.	4
Mixed objective/subjective test	A6 A8 A9 A10 B2 B5 B6 B8 B10 B11 B12 B13 B14 B15 B16 B19 B22 C10 C13	It will consist of two theoretical exams and problem solving on the contents exposed throughout the course during the lectures sessions, evaluating the understanding of such contents, and its application to problem solving.	60
Problem solving	A8 A9 B2 B5 B6 B10 B11 B12 B14 B15 B16 B19 B22	It will consist of problem-solving assessment through a set of tests.	30
Short answer questions	A6 A8 A9 A10 B2 B5 B6 B8 B10 B11 B12 B13 B14 B15 B16 B19 B22 C10 C13	At the beginning of each of the practices, the student should answer a set of short questions related to the theoretical concepts corresponding to the session.	2
Others			

Assessment comments

The mixed test and the problem-solving tests constitute 90% of the grade. The evaluation of the laboratory practices and through ICT, together with the short answer test, constitute the remaining 10%.
Description of the evaluation and distribution of points.
FIRST OPPORTUNITYA) MIXED TEST:
It will consist of two midterm exams of 6 points (maximum) each. In order to pass the course, a minimum of 3 points must be obtained in each one. Once obtained, the grade of the mixed exam will be the average of the grades of both midterm exams.If any of the midterm exams are not passed, the student will have the opportunity to pass them in the final exam (1st opportunity).B) PROBLEM SOLVING:
It will consist of a set of tests with a maximum combined score of 3 points, with a minimum of 1.5 to pass the course. If the tests are not passed, the student will have a problem-solving exam on the same date and time as the final exam (see section A). This exam must be passed in order to pass the course.C) LABORATORY/TIC PRACTICES:
It will consist of a set of laboratory and computer simulation (ICT) tasks with a maximum combined evaluation of 1 point, with a minimum of 0.5 to pass the course.If the assignments are not passed, the student will have a laboratory exam at the date and time established by the center. This exam must be passed in order to pass the course. FINAL GRADE: If all three parts (A, B and C) are passed, the final grade will be the sum of them. In case of failing, the final grade will be one half of such a sum.Additional work (optional): the student who has passed the course will have the option of voluntarily submitting a written work whose content and length (no more than 20 DINA4 pages, single spaced, New Roman font size 10 or similar, with margins of 2 cm on each side of the page) will be determined by the theory professor. The score for this work (1 point maximum) will be added to the FINAL grade indicated above (to be reduced if the maximum of 10 points is exceeded).Detection of plagiarism or copying of works: the fraudulent performance of the tests or evaluation activities will directly imply the qualification of failure '0' in the subject in the corresponding opportunity, thus invalidating any qualification obtained in all the evaluation activities for both the second and advanced opportunities.SECOND OPPORTUNITYThe grade obtained in the laboratory practices and problem solving will be maintained. The grades of the mid-term exams of the first opportunity will not be maintained. As in the case of the first opportunity, the mixed exam will consist of two midterm exams of 6 points (maximum) each. In order to pass the course, a minimum of 3 points must be obtained in each one. Once obtained, the grade of the mixed exam will be the average of the grades of both midterm exams. In case of not having passed the practices or problem solving, the student will have at his/her disposal the corresponding exams (similar and with the same conditions as those of the first opportunity).
Students enrolled part-time or who have been granted the academic waiver of exemption from attendance, as established in the "Norma que regula o réxime de dedicación ao estudo dos estudantes de grao na UDC" (Arts. 2.3; 3.b; 4.3 e 7.5) (04/05/2017), will take the same evaluation tests as students enrolled full-time. He/she will have the option to take a lab/ICT practicum exam at each opportunity.
The evaluation criteria contemplated in Table A-II/1 of the STCW Code, and included in the Quality Assurance System, will be taken into account when designing and carrying out the evaluation.

Sources of information	
Basic	- J. C. Brégains (). Material de la asignatura en moodle. Moodle (campusvirtual.udc.es) - J. M. Andión (). Prácticas de laboratorio y simulador. Moodle (campusvirtual.udc.es) - J. C. Brégains / P. Castro (2012). Electricidad Básica. Problemas Resueltos. Ed. Starbook - J. C. Brégains / P. Castro (2013). Electrónica Básica. Problemas Resueltos. Ed. Starbook - R. L. Boylestad (). Introducción al análisis de circuitos. Ed. Prentice Hall - R. L. Boylestad / L. Nashelsky (2009). Electrónica: teoría de circuitos y dispositivos electrónicos. Ed. Prentice Hall (10ª Edición) - Jacob Millman / Christos C. Halkias. (). Electrónica integrada: Circuitos y Sistemas Analógicos y Digitales. Editorial Hispano-Europea.- (6ª Edición). - J.A.Edminister (). Circuitos eléctricos . Ed. McGraw Hill (Serie Schaum).

Complementary	- Albert Malvino y David J. Bates (2010). Principios de electrónica. Mac Graw Hill. (7ª Edición). - Jacob Millman y Arvin Grabel. (). Microelectrónica. Editorial Hispano-Europea.(6ª edición). - Jacob Millman. (). Microelectrónica: Circuitos y Sistemas Analógicos y Digitales. Editorial Hispano-Europea. (3ª edición). - Jacob Millman y Christos C. Halkias (). Dispositivos y circuitos electrónicos. Editorial Pirámide. 10ª Edición. - Siglent Technologies (2014). SPD3000C Series Programmable DC Power Supply. Quick Start. Siglent Technologies - Keysight Technologies (2012). Osciloscopios de la serie 1000B de Keysight. Guía del usuario. Keysight Technologies - Siglent Technologies (2017). SDG800 Series Function/Arbitrary Waveform Generator. User Manual.. Siglent Technologies - Analog Devices (). Learn How to Use LTspice: Instructional Videos. Analog Devices

Recommendations
Subjects that it is recommended to have taken before
Mathematics I/631G01101 Phisics/631G01103 Mathematics II/631G01106
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
Ship's Energy and auxiliary systems/631G01204 Maritime Radiocommunications/631G01307 Navigation and communications systems/631G01311
Other comments