



## Teaching Guide

Identifying Data					2015/16
Subject (*)	Electrónica e Sist. Electrónicos do Buque	Code	631G02356		
Study programme	Grao en Tecnoloxías Mariñas				
Descriptors					
Cycle	Period	Year	Type	Credits	
Graduate	2nd four-month period	Third	Obligatoria	6	
Language	SpanishGalicianEnglish				
Teaching method	Face-to-face				
Prerequisites					
Department	Electrónica e Sistemas				
Coordinador	Novo Vidal, Maria Elena	E-mail	e.novo@udc.es		
Lecturers	Novo Vidal, Maria Elena Quintía Vidal, Pablo	E-mail	e.novo@udc.es pablo.quintia@udc.es		
Web					
General description					

## Study programme competences / results

Code	Study programme competences / results
A14	CE14 - Avaliación cualitativa e cuantitativa de datos e resultados, así como a representación e interpretación matemáticas de resultados obtidos experimentalmente.
A17	CE17 - Modelizar situacións e resolver problemas con técnicas ou ferramentas físico-matemáticas.
A18	CE18 - Redacción e interpretación de documentación técnica.
A47	CE32 - Utilizar as ferramentas manuais e o equipo de medida e proba eléctrico e electrónico para a detección de avarias e as operacións de mantemento e reparación.
B2	CT2 - Resolver problemas de forma efectiva.
B4	CT4 - Traballar de forma autónoma con iniciativa.
B5	CT5 - Traballar de forma colaboradora.
B8	CT8 - Versatilidade.
B9	CT9 - Capacidade para a aprendizaxe de novos métodos e teorías, que lle doten dunha gran versatilidade para adaptarse a novas situacións.
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.
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 vangardía do seu campo de estudo
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 / results		
Acquire the basic physical concepts related to ship engine room control systems: electrical and electronic circuits.	A14	B2	C3
	A17	B4	C6
	A18	B5	C9
	A47	B9	C13



Knowledge of the characteristics of basic semiconductor devices.	A14	B2	C3
	A17	B4	C6
	A18	B5	C9
	A47	B9	C13
Practical applications of analog and digital integrated circuits, and solid state devices.	A14	B2	C3
	A17	B4	C6
	A18	B5	C9
	A47	B8	C13
		B9	

Contents	
Topic	Sub-topic
THEME 1. SEMICONDUCTORS.	1.1. The Intrinsic Semiconductor. 1.2. Extrinsic Semiconductors. 1.3. Currents in a semiconductor
THEME 2. THE DIODE. CIRCUITS WITH DIODES.	2.1. The PN junction. 2.2. V-I characteristic of a diode. 2.3. Zener diodes. 2.4. LED diodes. 2.5. Linear model of the diode. 2.6. Analysis of circuits.
THEME 3. CIRCUITS WITH DIODES: RECTIFIERS.	3.1. Half-wave rectifier. 3.2. Full-wave rectifier. 3.3. Bridge rectifier.
THEME 4. THE BIPOLAR TRANSISTOR. CIRCUITS WITH BJT TRANSISTORS.	4.1. The Bipolar Transistor. 4.2. Current components. The V-I common-emitter (CE) characteristics. 4.3. Regions of operation and limit values. 4.4. Analysis of circuits.
THEME 5. UNIPOLAR TRANSISTOR. UNIPOLAR TRANSISTOR CIRCUITS.	5.1. Field-effect transistors: JFET, MOSFET. 5.2. The field-effect transistors V-I characteristics. 5.3. Analysis of circuits with field-effect transistors.
THEME 6. POWER DEVICES.	6.1. Power devices. 6.2. Thyristors. 6.3. Triacs. 6.4. Power regulation. 6.5. Analysis of circuits.
THEME 7. THE OPERATIONAL AMPLIFIER. LINEAR AND NONLINEAR APPLICATIONS.	7.1. Basics of amplification. 7.2. The Operational Amplifier. 7.3. Linear applications. 7.4. Nonlinear applications. 7.5. Analysis of circuits.
THEME 8. LOGIC GATES. LOGIC FAMILIES.	8.1. Digital circuits. 8.2. Logic gates. 8.3. Logic families: DTL, TTL and CMOS. 8.4. Analysis of circuits.



<p>THEME 9. SEQUENTIAL LOGIC. COMBINATORIAL LOGIC. MEMORIES.</p>	<p>9.1. Sequential systems. 9.2. The S-R, J-K-, T-, and D-Type Flip-Flops. 9.3. Registers. 9.4. Counters. 9.5. Combinatorial circuits. 9.6. Memories.</p>
<p>LABORATORY PRACTICE</p>	<p>PRACTICE 1: HARDWARE HANDLING 1.1. Power supply, multimeter, function generator and oscilloscope 1.2. Resistance Measurement 1.3. Measurement of voltages and currents in DC and AC  PRACTICE 5: OPERATIONAL AMPLIFIER 5.1. Inverting and non-inverting amplifier 5.2. Frequency response analysis 5.3. Open loop comparator and comparator with hysteresis</p>
<p>PROBLEM SOLVING AND GROUP TUTORING SESSIONS.</p>	<p>SESSION 1: Analysis of circuits with Diodes: linear model of the Diode. SESSION 2: Analysis of circuits with Diodes: Rectifiers. SESSION 3: Analysis of circuits with Bipolar Transistors. SESSION 4: Analysis of circuits with Bipolar Transistors. SESSION 5: Analysis of circuits with Unipolar Transistors. SESSION 6: Analysis of circuits with power devices. SESSION 7: Analysis of circuits with power devices. SESSION 8: Analysis of circuits with Operational Amplifiers.</p>
<p>ICT PRACTICALS</p>	<p>PRACTICE 2: RECTIFIER CIRCUITS 2.0. VI characteristics of diode 2.1. Half-wave rectification 2.2. Full-wave rectification. Filter capacitor  PRACTICE 3: BIPOLAR TRANSISTOR AND UNIPOLAR MOSFET 3.1. Input and output characteristic curves of common emitter bipolar transistor 3.2. Output and transfer characteristic curves of MOSFET common source  PRACTICE 4: POWER SEMICONDUCTOR DEVICES 4.1. Operational curve of the thyristor 4.2. Circuits using thyristor: Half-wave controlled rectifier  PRACTICE 6: BIPOLAR TRANSISTOR AND UNIPOLAR MOSFET IN SWITCHING 6.1. Switching operation of bipolar transistor 6.2. Switching operation of unipolar MOSFET  PRACTICE 7: CMOS INVERTER 7.1. CMOS inverter operation 7.2. Transfer characteristics  PRACTICE 8: LOGIC CIRCUITS 8.1. Logic functions. Logic gates 8.2. Combinatorial circuits 8.3. Sequential circuits</p>



Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Mixed objective/subjective test	A14 A17 A18 B2 C6 C9	3	0	3
Problem solving	A14 A17 A18 B2 B4 B8 C9 C6	8	16	24
ICT practicals	A47 B4 C3 C6	12	24	36
Laboratory practice	A14 A47 B2 B5 B9 C6	4	6	10
Guest lecture / keynote speech	A14 A17 A18 B2 B9 C13 C6	24	48	72
Short answer questions	A47 C6	2	0	2
Personalized attention		3	0	3

(\*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies	
Methodologies	Description
Mixed objective/subjective test	Mixed exam written by the theory Professor about the contents of the course.
Problem solving	Approach and resolution of problems related to the contents of the subject.
ICT practicals	Students will work on a series of practices on a PC using the electronic circuits simulator PSPICE.
Laboratory practice	Students will work on a series of practices in the Electronics Laboratory working with an electronic practice board.
Guest lecture / keynote speech	Didactic exposition, using slides and blackboard of the theoretical content of the subject.
Short answer questions	Short answer objective test to evaluate the knowledge and skills acquired by students in the management of electronic instrumentation during laboratory practices.

Personalized attention	
Methodologies	Description
Problem solving ICT practicals Laboratory practice Guest lecture / keynote speech	<p>Keynote session: attend to and answer questions from the students in relation to the theoretical material exposed in the keynote sessions.</p> <p>Problems solving: addressing and solving concerns of students in relation to the problems solved or posed by the teacher in the problem solving sessions.</p> <p>Practices through ICT: addressing and solving concerns of students in relation to ICT practices posed or carried out.</p> <p>Laboratory practice: attend and answer questions from students in relation to practices posed or carried out in the laboratory.</p> <p>Personal attention: in relation to classes of theory and problem solving sessions, preferably use tutoring hours individually.</p> <p>In relation to practical classes, hours of tutoring will be used preferably individually, by e-mail, or communication by Moodle.</p>

Assessment			
Methodologies	Competencies / Results	Description	Qualification



Mixed objective/subjective test	A14 A17 A18 B2 C6 C9	It will consist of a written exam of theory and problems in relation to the contents of the subject taking into account both the understanding and its application to problem solving.  The participation of the student in the exercises or works posed by the teacher during the course in the keynote and problem-solving sessions estimated positively.	80
Short answer questions	A47 C6	It will consist of a short answer questionnaire about the contents explained in the practical sessions, and which will evaluate not only the understanding of these, but the student's ability to establish critical judgements and the ability to manage the laboratory instrumentation.	14
ICT practicals	A47 B4 C3 C6	Realization of practical activities with the PSPICE simulator. The proper functioning of the final circuit will be evaluated as well as the reasoning behind it, explained against possible questions from the teacher during the sessions.	4
Laboratory practice	A14 A47 B2 B5 B9 C6	Realization of practical activities with an electronic demo board. The proper functioning of the final circuit will be evaluated as well as the reasoning behind it, explained against possible questions from the teacher during the sessions.	2
Others			

### Assessment comments

The evaluation of the content taught in masterclasses and problem solving sessions of the subject represents 80% of the total marks.

The evaluation of laboratory and ICT practices is the remaining 20%.

To pass the course will be required:

1) Mixed exam: written exam about the content taught in masterclasses and problem solving sessions: have a minimum of 3.8 points out of 8. The student must demonstrate a basic knowledge of all the content of the subject in this exam.

Works carried out independently by the student and posed by the Professor of theory can be presented optionally.

The participation of the student in the exercises or works posed by the teacher during the course in the keynote and problem-solving sessions estimated positively.

To pass the course 4 out of 8 must be reached in the final marks of theory and problems.

2) Have a minimum of 1 point out of the total obtained in the laboratory and ICT practice marks and in the practice test.

If 3.8 minimum is not obtained in the mixed exam, to calculate the final marks the practice marks will be divided by two.

"The evaluation criteria considered in tables A-III/1 and A - III/2 of the STCW Code and its amendments related to this subject shall be taken into account when designing and evaluating."

### Sources of information

<b>Basic</b>	<ul style="list-style-type: none"> <li>- Robert L. Boylestad y Louis Nashelsky (2009). Electrónica: Teoría de circuitos y dispositivos electrónicos. . Ed. Prentice Hall. 10ª Edición</li> <li>- José Luis Calvo Rolle (2003). Edición y simulación de circuitos con Orcad. Ed. Ra-Ma</li> <li>- Roy W. Goody (2002). Orcad PSpice para Windows, Vol. II: Dispositivos, circuitos y amplificadores operacionales. Ed. Prentice Hall</li> <li>- Pablo Quintía Vidal (2015). Prácticas de laboratorio y simulador. Moodle: <a href="https://moodle.udc.es">https://moodle.udc.es</a></li> <li>- Mª Elena Novo Vidal (2015). Copia de las diapositivas de la asignatura con problemas resueltos. Reprografía</li> <li>- Jacob Millman y Arvin Grabel (1995). Microelectrónica. Ed. Hispano Europea. 6ª Edición.</li> <li>- Albert Malvino y David J. Bates (2010). Principios de Electrónica.. Ed. McGraw Hill. 7ª Edición.</li> </ul> <p>&lt;br /&gt;</p>
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<b>Complementary</b>	<ul style="list-style-type: none"><li>- Jacob Millman y Christos C.Halkias (1982). Dispositivos y circuitos electrónicos. Ed. Pirámide. 10ª Edición.</li><li>- Albert Paul Malvino (2000). Principios de electrónica. Ed. McGraw Hill. 6ª Edición.</li><li>- F. Aldana Mayor y otros (1976). Electrónica I. Publicaciones E.T.S.I. Industriales Madrid</li><li>- Jacob Millman (1986). Microelectrónica. Circuitos y sistemas analógicos y digitales. Ed. Hispano Europea. 3ª Edición.</li><li>- Jacob Millman y Christos C.Halkias (1984). Electrónica integrada: Circuitos y sistemas analógicos y digitales. Ed. Hispano Europea. 6ª Edición.</li></ul> <p>&lt;br /&gt;</p>
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## Recommendations

### Subjects that it is recommended to have taken before

Matemáticas I/631G02151  
Física I/631G02153  
Informática/631G02154  
Matemáticas II/631G02156  
Física II/631G02158  
Electrotecnia. Máquinas Eléctricas e Sistemas Eléctricos do Buque/631G02253

### Subjects that are recommended to be taken simultaneously

Matemáticas III/631G02260  
Fundamentos de Regulación e Control/631G02257

### Subjects that continue the syllabus

Sistemas Electrónicos de Adquisición de Datos/631G02512  
Sistemas Electrónicos de Comunicacions e Axuda á Navegación/631G02461  
Electrónica Dixital/631G02364  
Electrónica Analóxica e de Potencia/631G02363  
Redes e Comunicacions/631G02366

### 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.