UNIVERSIDADE DA CORUÑA

| Teaching Guide | | | | |
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| 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<br>Quintía Vidal, Pablo | E-mail | e.novo@udc.es<br>pablo.quintia@udc.es | |
| Web | | | | |
| General description | | | | |

| Study programme competences / results | |
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| 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 avarías 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 vanguardia 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<br>A17<br>A18<br>A47 | B2<br>B4<br>B5<br>B9 | C3<br>C6<br>C9<br>C13 |

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

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

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

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

| Assessment | | | |
|---|---|---|---|
| Methodologies | Competencies / Results | Description | **Qualification** |

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| 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.<br>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 |
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| The evaluation of the content taught in masterclasses and problem solving sessions of the subject represents 80% of the total marks.<br>The evaluation of laboratory and ICT practices is the remaining 20%.<br>To pass the course will be required:<br>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.<br>Works carried out independently by the student and posed by the Professor of theory can be presented optionally.<br>The participation of the student in the exercises or works posed by the<br>teacher during the course in the keynote and problem-solving sessions estimated<br>positively.<br>To pass the course 4 out of 8 must be reached in the final marks of theory and problems.<br>2) Have a minimum of 1 point out of the total obtained in the laboratory and ICT practice marks and in the practice test.<br>If 3.8 minimum is not obtained in the mixed exam, to calculate the final marks the practice marks will be divided by two.<br>"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 | |
|---|---|
| Basic | - Robert L. Boylestad y Louis Nashelsky (2009). Electrónica: Teoría de circuitos y dispositivos electrónicos. . Ed. Prentice Hall. 10ª Edición<br>- José Luis Calvo Rolle (2003). Edición y simulación de circuitos con Orcad. Ed. Ra-Ma<br>- Roy W. Goody (2002). Orcad PSpice para Windows, Vol. II: Dispositivos, circuitos y amplificadores operacionales. Ed. Prentice Hall<br>- Pablo Quintía Vidal (2015). Prácticas de laboratorio y simulador. Moodle: https://moodle.udc.es<br>- Mª Elena Novo Vidal (2015). Copia de las diapositivas de la asignatura con problemas resueltos. Reprografía<br>- Jacob Millman y Arvin Grabel (1995). Microelectrónica. Ed. Hispano Europea. 6ª Edición.<br>- Albert Malvino y David J. Bates (2010). Principios de Electrónica.. Ed. McGraw Hill. 7ª Edición.<br><br /> |

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| Complementary | - Jacob Millman y Christos C.Halkias (1982). Dispositivos y circuitos electrónicos. Ed. Pirámide. 10ª Edición.<br>- Albert Paul Malvino (2000). Principios de electrónica. Ed. McGraw Hill. 6ª Edición.<br>- F. Aldana Mayor y otros (1976). Electróncia I. Publicaciones E.T.S.I. Industriales Madrid<br>- Jacob Millman (1986). Microelectrónica. Circuitos y sistemas analógicos y digitales. Ed. Hispano Europea. 3ª Edición.<br>- Jacob Millman y Christos C.Halkias (1984). Electrónica integrada: Circuitos y sistemas analógicos y digitales. Ed. Hispano Europea. 6ª Edición.<br><br /> |

| Recommendations |
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| **Subjects that it is recommended to have taken before** |
| Matemáticas 1/631G02151 |
| 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 Comunicacións e Axuda á Navegación/631G02461 |
| Electrónica Dixital/631G02364 |
| Electrónica Analóxica e de Potencia/631G02363 |
| Redes e Comunicacións/631G02366 |
| **Other comments** |
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