



## Teaching Guide

| Teaching Guide      |                                                                                                                                                                                                                                                                                                                                                          |        |                                            |           |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------------------------------------------|-----------|
| Identifying Data    |                                                                                                                                                                                                                                                                                                                                                          |        |                                            | 2020/21   |
| Subject (*)         | Electronic Systems for Vessels                                                                                                                                                                                                                                                                                                                           |        | Code                                       | 631G02356 |
| Study programme     | Grao en Tecnoloxías Mariñas                                                                                                                                                                                                                                                                                                                              |        |                                            |           |
| Descriptors         |                                                                                                                                                                                                                                                                                                                                                          |        |                                            |           |
| Cycle               | Period                                                                                                                                                                                                                                                                                                                                                   | Year   | Type                                       | Credits   |
| Graduate            | 2nd four-month period                                                                                                                                                                                                                                                                                                                                    | Third  | Optional                                   | 6         |
| Language            | Spanish                                                                                                                                                                                                                                                                                                                                                  |        |                                            |           |
| Teaching method     | Hybrid                                                                                                                                                                                                                                                                                                                                                   |        |                                            |           |
| Prerequisites       |                                                                                                                                                                                                                                                                                                                                                          |        |                                            |           |
| Department          | Enxeñaría de Computadores                                                                                                                                                                                                                                                                                                                                |        |                                            |           |
| Coordinador         | Novo Vidal, Maria Elena                                                                                                                                                                                                                                                                                                                                  | E-mail | e.novo@udc.es                              |           |
| Lecturers           | Andión Fernández, José Manuel<br>Novo Vidal, Maria Elena                                                                                                                                                                                                                                                                                                 | E-mail | jose.manuel.andion@udc.es<br>e.novo@udc.es |           |
| Web                 | moodle.udc.es/                                                                                                                                                                                                                                                                                                                                           |        |                                            |           |
| General description |                                                                                                                                                                                                                                                                                                                                                          |        |                                            |           |
| Contingency plan    | 1. Modifications to the contents<br><br>2. Methodologies<br>*Teaching methodologies that are maintained<br><br>*Teaching methodologies that are modified<br><br>3. Mechanisms for personalized attention to students<br><br>4. Modifications in the evaluation<br><br>*Evaluation observations:<br><br>5. Modifications to the bibliography or webgraphy |        |                                            |           |

## Study programme competences

| Code | Study programme competences                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A7   | CE7 - Capacidade para a operación e posta en marcha de novas instalacións ou que teñan por obxecto a construción, reforma, reparación, conservación, instalación, montaxe ou explotación, realización de medicións, cálculos, valoracións, taxacións, peritacións, estudos, informes, e outros traballos análogos de instalacións enerxéticas e industriais mariñas, nos seus respectivos casos, tanto con carácter principal como accesorio, sempre que quede comprendido pola súa natureza e característica na técnica propia da titulación, dentro do ámbito da súa especialidade, é dicir, operación e explotación.     |
| 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.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| A30  | CE42 - Operar, reparar, manter, reformar, optimizar a nivel operacional as instalacións industriais relacionadas coa enxeñaría mariña, como motores alternativos de combustión interna e subsistemas; turbinas de vapor, caldeiras e subsistemas asociados; ciclos combinados; propulsión eléctrica e propulsión con turbinas de gas; equipos eléctricos, electrónicos, e de regulación e control do buque; as instalacións auxiliares do buque, tales como instalacións frigoríficas, sistemas de goberno, instalacións de aire acondicionado, plantas potabilizadoras, separadores de sentinas, grupos electrógenos, etc. |
| A31  | CE43 - Operar, reparar, manter e optimizar as instalacións auxiliares dos buques que transportan cargas especiais, tales como quimiqueiros, LPG, LNG, petroleiros, cimenteiros, Ro-Ro, Pasaxe, botes rápidos, etc.                                                                                                                                                                                                                                                                                                                                                                                                          |



|     |                                                                                                                                                                                                     |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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.                                 |
| A63 | CE53 - Supervisar o funcionamento dos sistemas eléctricos, electrónicos e de control                                                                                                                |
| A68 | CE58 - Manter e reparar o equipo eléctrico e electrónico                                                                                                                                            |
| 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 |        |
| Acquire the basic physical concepts related to ship engine room control systems: electrical and electronic circuits. |  | A7                          | B2 C3  |
|                                                                                                                      |  | A14                         | B4 C6  |
|                                                                                                                      |  | A17                         | B5 C9  |
|                                                                                                                      |  | A18                         | B9 C13 |
|                                                                                                                      |  | A30                         |        |
|                                                                                                                      |  | A47                         |        |
| 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  |
|                                                                                                                      |  | A30                         | B8 C13 |
|                                                                                                                      |  | A31                         | B9     |
|                                                                                                                      |  | A47                         |        |
|                                                                                                                      |  | A63                         |        |
|                                                                                                                      |  | A68                         |        |

| Contents                 |                                                                                                         |
|--------------------------|---------------------------------------------------------------------------------------------------------|
| 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 amplification.<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.                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| THEME 9. SEQUENTIAL LOGIC. COMBINATORIAL LOGIC.                        | 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.                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 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.<br>SESSION 9: Analysis of circuits with Operational Amplifiers. |
| LABORATORY PRACTICE SESSIONS                                           | PRACTICE 1: Use of measuring instruments for direct current.<br>PRACTICE 2: Use of measuring instruments for alternating current.<br>PRACTICE 3: V-I characteristic of a diode. LEDs.<br>PRACTICE 4: Rectifier circuits.<br>PRACTICE 5: Bipolar transistors.                                                                                                                                                                                                                                                                                                     |



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| ICT PRACTICE SESSIONS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <p>PRACTICE 6: Unipolar transistors.</p> <p>PRACTICE 7: Thyristors.</p> <p>PRACTICE 8: Operational amplifiers.</p> <p>PRACTICE 9: The CMOS inverter.</p>                                                       |
| By the development and passing of these contents together with those corresponding to other subjects that includes the acquisition of competences specific to the degree, the knowledge, comprehension and adequacy of the competences contained in Table A11/2, of the STCW Convention is guaranteed, in relation to the level of management of a Chief Mate of the merchant navy on ships without gross tonnage limitation, and a Master of the merchant navy for those of up to a maximum of 500 GT. | <p>Table A-II / 2 of the STCW Convention.</p> <p>Specification of the mandatory minimum requirements of competence for the certification of masters and chief mates on ships of 500 gross tonnage or more.</p> |

| Planning                                                                                                                        |                                 |                      |                               |             |
|---------------------------------------------------------------------------------------------------------------------------------|---------------------------------|----------------------|-------------------------------|-------------|
| Methodologies / tests                                                                                                           | Competencies                    | Ordinary class hours | Student's personal work hours | Total hours |
| Guest lecture / keynote speech                                                                                                  | A14 A17 A18 B2 B9 C6 C13        | 27                   | 54                            | 81          |
| Problem solving                                                                                                                 | A14 A17 A18 B2 B4 B8 C6 C9      | 9                    | 18                            | 27          |
| Mixed objective/subjective test                                                                                                 | A7 A14 A17 A18 A30 A31 B2 C6 C9 | 4                    | 0                             | 4           |
| Laboratory practice                                                                                                             | A14 A18 A47 A63 A68 B5 B9 C6    | 10                   | 10                            | 20          |
| ICT practicals                                                                                                                  | A14 A17 A18 B2 B4 B8 B9 C3 C6   | 8                    | 8                             | 16          |
| Short answer questions                                                                                                          | A14 A17 A47 B2 C3 C6            | 2                    | 0                             | 2           |
| Personalized attention                                                                                                          |                                 | 0                    | 0                             | 0           |
| (*)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 blackboard of the theoretical content of the subject.                                                                        |
| Problem solving                 | Approach and resolution of problems related to the contents of the subject.                                                                                        |
| Mixed objective/subjective test | Mixed exam written by the theory Professor about the contents of the course.                                                                                       |
| Laboratory practice             | Students will work on a series of practices in the Electronics Laboratory working with an electronic practice board.                                               |
| ICT practicals                  | Students will work on a series of practices on a PC using the electronic circuits simulator LTspice.                                                               |
| 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 |



|                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ICT practicals<br>Laboratory practice<br>Guest lecture /<br>keynote speech<br>Problem solving | <p>Keynote session: assist 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>Laboratory practice: assist and answer questions from students in relation to practices posed or carried out in the laboratory.</p> <p>Practices through ICT: addressing and solving concerns of students in relation to ICT practices posed or carried out.</p> <p>Personal attention: in relation to classes of theory and problem solving sessions, preferably using tutoring hours individually. In relation to practical classes, hours of tutoring will be used preferably individually, although e-mail will be possible.</p> |
|-----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

| Assessment                            |                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |               |
|---------------------------------------|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Methodologies                         | Competencies                       | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Qualification |
| Mixed<br>objective/subjective<br>test | A7 A14 A17 A18 A30<br>A31 B2 C6 C9 | <p>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.</p> <p>For students (matriculated full-time or part-time) who regularly attend class (minimum 80% attendance), partial exams could be made throughout the course that could exempt part or all of the subject in the final mixed test.</p> <p>Works carried out independently by the student and posed by the Professor of theory can be presented optionally.</p> <p>The participation of the student in the exercises or works posed by the teacher during the course in the keynote and problem-solving sessions and in the tutorials estimated positively.</p> <p>To pass the course 4 out of 8 must be reached in the final marks of theory and problems.</p> | 80            |
| Short answer<br>questions             | A14 A17 A47 B2 C3<br>C6            | <p>It will consist of a short answer questionnaire about the contents of the practical sessions. It will evaluate not only the understanding of these, but also the student's ability to establish critical judgements and the ability to manage the laboratory instrumentation.</p> <p>For students (matriculated full-time or part-time) who regularly attend class (minimum 80% attendance), a continuous assessment could be made throughout the course that could exempt part or all of the subject in the final short answer questionnaire.</p> <p>The participation of the student in the practical sessions and his explanations to questions posed by the teacher during the sessions will be considered.</p>                                                                                                                                                                           | 20            |
| 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 by the short answer questions 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. To pass the exam none of the answers to the questions can be blank.

For students (matriculated full time or part time) who regularly attend class (minimum 80% attendance), partial exams could be made throughout the course that could exempt part or all of the subject in the final mixed test.

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

Answers to the teacher during the course in the keynote and problem-solving sessions and in the tutorials could be 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 2 in the short answer questionnaire.

For students (matriculated full time or part time) who regularly attend class (minimum 80% attendance), a continuous assessment could be made throughout the course that could exempt part or all of the subject in the final short answer questionnaire.

The participation of the student in the practical sessions and his explanations to questions posed by the teacher during the sessions will be considered.

If a minimum of 4 out of 8 is not obtained in the final marks of theory and problems, the practice marks will be divided by two to calculate the final marks. If in practice the minimum 1 was not obtained, to calculate the final grade the geometric mean weighted will be made.

In order to be able to pass the subject, full-time and part-time students must attend more than the 80 % of the ordinary class hours of "Laboratory practice" and "ICT practicals" (unless she/he has attended in previous years). The students which have the academic exemption of attendance, according to 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 replace this requirement with an aptitude test about the use of the laboratory instrumentation.

The evaluation criteria

considered in tables A-III/1 and A-III/3 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>- Jacob Millman y Christos C.Halkias (1984 ). Electrónica Integrada:Circuitos y Sistemas Analógicos y Digitales. Ed. Hispano Europea. 4ª Edición.</li> <li>- Mª Elena Novo Vidal (2020). Copia de las diapositivas de la asignatura con problemas resueltos. Reprografía</li> <li>- José Manuel Andiñón Fernández (2020). Prácticas de laboratorio y simulador. Moodle: <a href="https://moodle.udc.es/">https://moodle.udc.es/</a></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Complementary</b> | <ul style="list-style-type: none"> <li>- Jacob Millman (1986). Microelectrónica. Circuitos y sistemas analógicos y digitales. Ed. Hispano Europea. 3ª Edición.</li> <li>- Jacob Millman y Christos C.Halkias (1982). Dispositivos y circuitos electrónicos. Ed. Pirámide. 10ª Edición.</li> <li>- Jacob Millman y Arvin Gabel (1995). Microelectrónica . Ed. Hispano Europea. 6ª Edición.</li> <li>- F. Aldana Mayor y otros (1976). Electrónica I. Publicaciones E.T.S.I. Industriales Madrid</li> <li>- Albert Malvino y David J. Bates (2010). Principios de Electrónica. Ed. McGraw Hill. 7ª Edición.</li> <li>- Albert Paul Malvino (2000). Principios de electrónica. Ed. McGraw Hill. 6ª Edición.</li> <li>- Keysight Technologies (2012). Osciloscopios de la serie 1000B de Keysight. Guía del usuario.. Keysight Technologies</li> <li>- Siglent Technologies (2017). SDG800 Series Function/Arbitrary Waveform Generator. User Manual. Siglent Technologies</li> <li>- Linear Technology (2009). LTspice User Manual. Linear Technology</li> <li>- Varios Autores (2020). LTspice Users Group. <a href="https://groups.io/g/LTspice">https://groups.io/g/LTspice</a></li> </ul> |



| Recommendations                                                                                                                                                                                                                           |
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| Subjects that it is recommended to have taken before                                                                                                                                                                                      |
| Mathematics I/631G02151<br>Electricity and Electronics/631G01206<br>Physics I/631G02153<br>Informatics/631G02154<br>Mathematics II/631G02156<br>Physics II/631G02158                                                                      |
| Subjects that are recommended to be taken simultaneously                                                                                                                                                                                  |
| Mathematics III/631G02260<br>Regulation and Control Fundamentals/631G02257                                                                                                                                                                |
| Subjects that continue the syllabus                                                                                                                                                                                                       |
| Electronic Systems for Data Acquisition/631G02512<br>Electronic Communication Systems and Navigation Aids/631G02457<br>Digital Electronics/631G02364<br>Power and Analogue Electronics/631G02363<br>Networks and Communications/631G02366 |
| Other comments                                                                                                                                                                                                                            |
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(\*)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.