



## Teaching Guide

| Teaching Guide      |                                                                                                                                |        |             |                                                |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------|--------|-------------|------------------------------------------------|
| Identifying Data    |                                                                                                                                |        |             | 2017/18                                        |
| Subject (*)         | Fundamentals of Electricity                                                                                                    |        | Code        | 730G03012                                      |
| Study programme     | Grao en Enxeñaría Mecánica                                                                                                     |        |             |                                                |
| Descriptors         |                                                                                                                                |        |             |                                                |
| Cycle               | Period                                                                                                                         | Year   | Type        | Credits                                        |
| Graduate            | 1st four-month period                                                                                                          | Second | Obligatoria | 6                                              |
| Language            | SpanishGalician                                                                                                                |        |             |                                                |
| Teaching method     | Face-to-face                                                                                                                   |        |             |                                                |
| Prerequisites       |                                                                                                                                |        |             |                                                |
| Department          | Enxeñaría Industrial                                                                                                           |        |             |                                                |
| Coordinador         | Menacho Garcia, Carlos Miguel                                                                                                  |        | E-mail      | miguel.menacho@udc.es                          |
| Lecturers           | Menacho Garcia, Carlos Miguel<br>Santome Couto, Emilio                                                                         |        | E-mail      | miguel.menacho@udc.es<br>emilio.santome@udc.es |
| Web                 | moodle.udc.es                                                                                                                  |        |             |                                                |
| General description | In this course, the analysis of electrical circuits and a brief introduction to the operation of electric machines is studied. |        |             |                                                |

## Study programme competences

| Code | Study programme competences                                                                                                                                                                                                                                                                                                   |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A10  | Coñecemento e utilización dos principios de teoría de circuítos e máquinas eléctricas.                                                                                                                                                                                                                                        |
| B1   | Que os estudantes demostren posuír e comprender coñecementos nunha área de estudo que parte da base da educación secundaria xeral e adoita encontrarse a un nivel que, aínda que se apoia en libros de texto avanzados, inclúe tamén algúns aspectos que implican coñecementos procedentes da vangarda do seu campo de estudo |
| B2   | Que os estudantes saiban aplicar os seus coñecementos ao seu traballo ou vocación dunha forma profesional e posúan as competencias que adoitan demostrarse por medio da elaboración e defensa de argumentos e a resolución de problemas dentro da súa área de estudo                                                          |
| B3   | Que os estudantes teñan a capacidade de reunir e interpretar datos relevantes (normalmente dentro da súa área de estudo) para emitiren xuízos que inclúan unha reflexión sobre temas relevantes de índole social, científica ou ética                                                                                         |
| B5   | Que os estudantes desenvolvan aquelas habilidades de aprendizaxe necesarias para emprenderen estudos posteriores cun alto grao de autonomía                                                                                                                                                                                   |
| B7   | Ser capaz de realizar unha análise crítica, avaliación e síntese de ideas novas e complexas                                                                                                                                                                                                                                   |
| C1   | 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.                                                                                                                                               |
| C4   | Valorar criticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben enfrontarse.                                                                                                                                                                                             |
| C5   | Asumir como profesional e cidadán a importancia da aprendizaxe ao longo da vida.                                                                                                                                                                                                                                              |

## Learning outcomes

| Learning outcomes                                                                                                                                                                                           | Study programme competences |                            |                |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|----------------------------|----------------|
| Apply Ohm's law and Kirchhoff's laws.<br>Use correct general methods of analysis of DC circuits.<br>Analyze any direct current circuit using the most appropriate method.                                   | A10                         | B1<br>B2<br>B3<br>B5<br>B7 | C1<br>C4<br>C5 |
| Interpret and differentiate between different types of ac power.<br>Use correct general methods of analysis of alternating current circuits.<br>Analyzing any AC circuit using the most appropriate method. | A10                         | B1<br>B2<br>B3<br>B5<br>B7 | C1<br>C4<br>C5 |



|                                                                                                                                                                                                                                                                                                                                                                                                         |     |                            |                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------------------------|----------------|
| To analyze the operation of the three-phase balanced and unbalanced circuits.<br>Interpret, differentiate and measure various types of power present in three-phase circuits.                                                                                                                                                                                                                           | A10 | B1<br>B2<br>B3<br>B5<br>B7 | C1<br>C4<br>C5 |
| Understanding the difference between the transitional regime and the steady or stationary state of a circuit.<br>Learn to get the relevant initial conditions in an electrical circuit.<br>Clearly identify the final steady state (elapsed long enough) expected of a circuit.<br>Distinguish circuits first and second order.<br>Get representative differential equation for each circuit transient. | A10 | B1<br>B2<br>B3<br>B5<br>B7 | C1<br>C4<br>C5 |
| Know the basic principles of electromagnetic energy conversion system.<br>Know the basics and general operating principles of electric machines.                                                                                                                                                                                                                                                        | A10 | B1<br>B2<br>B3<br>B5<br>B7 | C1<br>C4<br>C5 |

| Contents                                           |                                                                                                                                           |
|----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Topic                                              | Sub-topic                                                                                                                                 |
| Analysis of DC circuits                            | Basics<br>Circuit elements<br>Association of elements<br>Waveforms<br>Mesh analysis<br>Nodal analysis<br>Circuit Theorems                 |
| Analysis of AC circuits                            | Basics<br>Analysis of circuits in sinusoidal steady state<br>Power and energy steady state sinusoidal<br>Theorems steady state sinusoidal |
| Analysis three-phase circuits                      | Overview<br>Balanced and unbalanced three-phase circuits<br>Power in three-phase circuits<br>Measurement of power in three-phase circuits |
| Circuit analysis transient                         | Basics<br>First order circuits<br>Second order circuits<br>Laplace Transform                                                              |
| Introduction to the operation of electric machines | Magnetic circuits and energy conversion<br>General principles of electrical machines                                                      |

| Planning                       |                                |                      |                               |             |
|--------------------------------|--------------------------------|----------------------|-------------------------------|-------------|
| Methodologies / tests          | Competencies                   | Ordinary class hours | Student?s personal work hours | Total hours |
| Introductory activities        | A10                            | 1.5                  | 0                             | 1.5         |
| Guest lecture / keynote speech | A10 B1 B2 B3 B5 B7<br>C1 C4 C5 | 24                   | 38                            | 62          |
| Problem solving                | A10 B1 B2 B3 B5 B7<br>C1 C4 C5 | 22                   | 33                            | 55          |
| Laboratory practice            | A10 B1 B2 B3 B5 B7<br>C1 C4 C5 | 9                    | 5                             | 14          |



|                                                                                                                                 |     |     |    |     |
|---------------------------------------------------------------------------------------------------------------------------------|-----|-----|----|-----|
| Objective test                                                                                                                  | A10 | 2   | 12 | 14  |
| Multiple-choice questions                                                                                                       | A10 | 0.5 | 2  | 2.5 |
| 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Introductory activities        | Presentation of the subject, in large group (GG). Teachers: Miguel Menacho (theory and problems) and Emilio Santomé (Workshop Practice).                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Guest lecture / keynote speech | Oral presentation complemented the use of media and the introduction of questions aimed at motivating students, in order to impart knowledge and facilitate learning.<br><br>Corresponds to the kind of theory, large group (GG). Professor Miguel Menacho.                                                                                                                                                                                                                                                                                                                                                |
| Problem solving                | Technique by to be solved a particular problem situation, from the knowledge and procedures that have been studied and worked.<br><br>Corresponds to the class of problems, medium (GM) group. Professor Miguel Menacho.                                                                                                                                                                                                                                                                                                                                                                                   |
| Laboratory practice            | Methodology that allows students to apply the knowledge acquired through the completion of practical activities.<br><br>It is for the workshop exercises, small group (GP). Instructor: Emilio Santomé.                                                                                                                                                                                                                                                                                                                                                                                                    |
| Objective test                 | Written test used for the assessment of learning.<br><br>In order to more rigorously assess the achievement of the objectives, the test consists of two parts: multiple choice questions (items) and problem solving.<br><br>Multiple choice questions (items) is a measuring instrument, whose distinctive feature is that it allows the answers qualify as correct or not; and to assess the knowledge acquired.<br><br>Troubleshooting: part that is intended to evaluate conceptual, procedural and attitudinal.<br><br>It is for the consideration of theory and problems. Instructor: Miguel Menacho |
| Multiple-choice questions      | Objective test consisting raise a question as direct question or incomplete statement with several response options or alternatives that provide possible solutions, of which only one is valid.<br><br>Corresponds to practice exam workshop. Instructor: Emilio Santomé.                                                                                                                                                                                                                                                                                                                                 |

| Personalized attention |                   |
|------------------------|-------------------|
| Methodologies          | Description       |
| Objective test         | Tutorials review. |

| Assessment    |              |             |               |
|---------------|--------------|-------------|---------------|
| Methodologies | Competencies | Description | Qualification |



|                           |                                |                                                                                                                                                                                                                                                                                                                                                                                                                    |    |
|---------------------------|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Multiple-choice questions | A10                            | <p>In the January announcement, the grade will be the sum of the amount of the assistance and assessment practices workshop note, which is valued between 0 and 5 points, and the note of a final exam (multiple choice test), which was also assessed from 0 to 5 points.</p> <p>In the July, qualifying match corresponding note final exam (multiple choice test), which is valued between 0 and 10 points.</p> | 10 |
| Objective test            | A10                            | This test involves problem solving and / or items, and will be computed between 0 and 10 points.                                                                                                                                                                                                                                                                                                                   | 80 |
| Laboratory practice       | A10 B1 B2 B3 B5 B7<br>C1 C4 C5 | <p>In the January announcement, the grade will be the sum of the amount of the assistance and assessment practices workshop note, which is valued between 0 and 5 points, and the note of a final exam (multiple choice test), which was also assessed from 0 to 5 points.</p> <p>In the July, qualifying match corresponding note final exam (multiple choice test), which is valued between 0 and 10 points.</p> | 10 |

## Assessment comments

To pass the subject it is necessary to approve the part of theory and problems and the part of laboratory practices. The subject will also be approved if it reaches a mark of more than or equal to 3'5 points in the note of laboratory practices, compensate with the part of theory and problems. The final grade is the sum of the (theory and problems note) \* 0'80 and the (laboratory practice note) \* 0'20. In the presentation of the subject (first day of class) may indicate additional activities whose assessment will add to the note of the objective test of the part of theory and problems. In any case, the note of this part can not be more than 10 points.

## Sources of information

|               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Basic         | <ul style="list-style-type: none"> <li>- Fraile Mora, J. (2012). Circuitos eléctricos. Madrid: Pearson</li> <li>- Alexander, C.K. y Sadiku, M.N.O. (2013). Fundamentos de circuitos eléctricos. Méjico: McGraw-Hill</li> <li>- Eguiluz Morán, L.I. (1986). Pruebas objetivas de ingeniería eléctrica. Madrid: Alhambra</li> <li>- Fraile Mora, J. (2008). Máquinas eléctricas. Madrid: McGraw-Hill</li> <li>- Parra, V. et al. (1976). Unidades didácticas de teoría de circuitos (2 vols.). Madrid: UNED</li> <li>- Eguiluz Morán, L.I. y Sánchez Barrios, P. (1989). Pruebas de examen de teoría de circuitos. Santander: Universidad de Cantabria</li> <li>- Eguiluz Morán, L.I. et al. (2001). Pruebas objetivas de circuitos eléctricos. Barañáin (Navarra): EUNSA</li> <li>- Humet, L., Alabern, X. y García, A. (1997). Tests de Electrotecnia. Fundamentos de circuitos. Barcelona: Marcombo</li> <li>- Sánchez Barrios, P. et al. (2007). Teoría de circuitos: problemas y pruebas objetivas orientadas al aprendizaje.. Madrid: Pearson/Prentice Hall</li> <li>- Paul, C.R. (2001). Fundamentals of electric circuits analysis. USA: John Willey and Sons</li> </ul> |
| Complementary |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

## Recommendations

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

Calculus /730G03001  
 Linear Algebra/730G03006  
 Physics II/730G03009

### Subjects that are recommended to be taken simultaneously

### Subjects that continue the syllabus



Fundamentals of Electronic Circuits/730G03016

Installations for Industrial Plants/730G03031

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.