

## 28812 - Electrical Engineering

### Información del Plan Docente

Academic Year	2017/18
Faculty / School	175 - Escuela Universitaria Politécnica de La Almunia
Degree	424 - Bachelor's Degree in Mechatronics Engineering
ECTS	6.0
Year	2
Semester	First semester
Subject Type	Compulsory
Module	---

### **1.General information**

#### **1.1.Introduction**

#### **1.2.Recommendations to take this course**

#### **1.3.Context and importance of this course in the degree**

#### **1.4.Activities and key dates**

### **2.Learning goals**

#### **2.1.Learning goals**

#### **2.2.Importance of learning goals**

### **3.Aims of the course and competences**

#### **3.1.Aims of the course**

#### **3.2.Competences**

### **4.Assessment (1st and 2nd call)**

#### **4.1.Assessment tasks (description of tasks, marking system and assessment criteria)**

### **5.Methodology, learning tasks, syllabus and resources**

#### **5.1.Methodological overview**

The learning process designed for this subject is based on the following:

Strong interaction between the teacher/student. This interaction is brought into being through a division of work and responsibilities between the students and the teacher. Nevertheless, it must be taken into account that, to a certain degree, students can set their learning pace based on their own needs and availability, following the guidelines set by the teacher.

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The current subject, Electric Engineering, is conceived as a stand-alone combination of contents, yet organized into three fundamental and complementary forms, which are: the theoretical concepts of each teaching unit, the solving of problems or resolution of questions and laboratory work, at the same time supported by other activities .

The organization of teaching will be carried out using the following steps:

- **Theory Classes.** Theoretical activities carried out mainly through exposition by the teacher, where the theoretical supports of the subject are displayed, highlighting the fundamental, structuring them in topics and or sections, interrelating them.
- **Practical Classes.** The teacher resolves practical problems or cases for demonstrative purposes. This type of teaching complements the theory shown in the lectures with practical aspects.
- **Laboratory Workshop.** The lecture group is divided up into various groups, according to the number of registered students, but never with more than 20 students, in order to make up smaller sized groups.
- **Individual Tutorials.** Those carried out giving individual, personalized attention of the teacher. Said tutorials may be in person or online.

### 5.2.Learning tasks

The programme offered to the student to help them achieve their target results is made up of the following activities...

Involves the active participation of the student, in a way that the results achieved in the learning process are developed, not taking away from those already set out, the activities are the following:

&mdash; **Face-to-face generic activities :**

&#9679; **Theory Classes :** The theoretical concepts of the subject are explained and illustrative examples are developed as support to the theory when necessary.

&#9679; **Practical Classes :** Problems and practical cases are carried out, complementary to the theoretical concepts studied.

&#9679; **Laboratory Workshop :** This work is tutored by a teacher, in groups of no more than 20 students.

&mdash; **Generic non-class activities :**

&#9679; Study and understanding of the theory taught in the lectures.

&#9679; Understanding and assimilation of the problems and practical cases solved in the practical classes.

&#9679; Preparation of seminars, solutions to proposed problems, etc.

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• Preparation of laboratory workshops, preparation of summaries and reports.

• Preparation of the written tests for continuous assessment and final exams.

The subject has 6 ECTS credits, which represents 150 hours of student work in the subject during the trimester, in other words, 10 hours per week for 15 weeks of class.

A summary of a weekly timetable guide can be seen in the following table. These figures are obtained from the subject file in the Accreditation Report of the degree, taking into account the level of experimentation considered for the said subject is moderate.

Activity	Weekly school hours
Lectures	3
Laboratory Workshop	1
Other Activities	6

Nevertheless the previous table can be shown into greater detail, taking into account the following overall distribution:

– 45 hours of lectures, with 50% theoretical demonstration and 50% solving type problems.

– 11 hours of laboratory workshop, in 1 or 2 hour sessions.

– 4 hours of written assessment tests, two hour per test.

– 4 hours of PPT presentations.

– 34 hours of exercises and tutorial works, divided up over the 15 weeks of the 1 st semester.

– 50 hours of personal study, divided up over the 15 weeks of the 1 st semester.

### 5.3.Syllabus

The course is structured around two complementary components: theoretical and practical. The concepts and fundamentals of electrical circuit analysis, illustrated with actual examples, will be presented. The student participation through questions and brief discussions will be encouraged.

The contents of the theoretical classes are the following:

### Chapter I: Basic concepts.

- Introduction and definitions.
- Components of a network.
- Ideal generators.
- Fundamental properties.
- Notation and references.
- Basic analysis techniques.

### Chapter II: Techniques of circuit analysis.

- Divider circuits.
- Basic element connections.
- Other connections.
- Equivalence between sources.
- Thévenin and Norton equivalents.
- Other circuit theorems.

### Chapter III: Analysis of elementary networks in the time domain.

- Introduction and considerations.
- Sinusoidal signal: representation.
- Concept of phasor.
- Phasor relations for R, L and C.
- Kirchhoff: frequency domain.
- Impedance: phasor relationships.

### Chapter IV: An introduction to three-phase systems.

- Single-phase and 3-phase networks.
- Star-triangle relationships.
- Voltage, current, power.

### Chapter V: Analysis of elementary networks in the time domain.

- Introduction, simple RL circuit.
- Properties of the exponential response.
- General RL circuit.
- Simple RC circuit.
- General RC circuit.
- RLC parallel circuit (unsourced).
- RLC series circuit (unsourced).
- The complete response of an RLC circuit.
- Circuit analysis using the Laplace Transform.

### Chapter VI: Fundamental principles of electrical machines.

- Introduction.
- Basics of electrical machines.
- Types of electrical machines. General classification.
- Main characteristics of electrical machines.
- Performance and loss of electrical machines.
- Electromotive force induced in the windings.
- Electromagnetic torque.

## 5.4.Course planning and calendar

### Schedule sessions and presentation of works

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Lectures and problem resolution classes and laboratory workshop are according to schedule set by the center, which must be published before the start date of classes ( <http://www.eupla.es/> ) .

The teacher will inform about his hours of tutoring.

Other activities will be planned depending on the number of students and will be announced with time . It will be available on <https://moodle.unizar.es/>

### 5.5. Bibliography and recommended resources

The updated bibliography of the subject is consulted through the web page of the library:

<http://psfunizar7.unizar.es/br13/eBuscar.php?tipo=a>

- \* Circuitos eléctricos para la ingeniería / Antonio J. Conejo [et al.] Madrid [etc.]: McGraw-Hill, D.L. 2004.
- \* Edminister, Joseph A. Circuitos eléctricos / Joseph A. Edminister, Mahmood Nahvi; traducción, Rafael Sanjurjo Navarro, Eduardo Lázaro Sánchez, Pablo de Miguel Rodríguez. - 3ª ed. Madrid [etc.]: McGraw-Hill, D.L. 2001.
- \* Fraile Mora, Jesús. Máquinas eléctricas / Jesús Fraile Mora. - 6ª ed. Madrid: McGraw-Hill/Interamericana, cop. 2008.
- \* Hayt, William Hart, jr. Análisis de circuitos en ingeniería / William H. Hayt, Jr., Jack E. Kemmerly, Steven M. Durbin; revisión técnica, Gloria Mata Hernández, Nathan Witemberg Wudka, Alejandro Vega Salinas . 8ª ed. México [etc.]: McGraw Hill, cop. 2012.
- \* López Ferreras, Francisco. Análisis de circuitos lineales / Francisco López Ferreras; coautores, Saturnino Maldonado Basión y Manuel Rusa Zurera. - 3ª ed. Paracuellos de Jarama, Madrid: Ra-Ma, D.L. 2009.
- \* Nilsson, James W. Circuitos eléctricos / James W. Nilsson, Susan A. Riedel. 7ª ed. Madrid: Pearson Educación, 2005.
- \* Warzanskyj Poliscuk, Wsewolod. Análisis de circuitos / Wsewolod Warzanskyj Poliscuk. 4ª ed. Madrid: E.T.S. de Ingenieros de Telecomunicación, Departamento de Publicaciones, 1985.
- \* Cortés Cherta, Manuel. Teoría general de máquinas eléctricas: (ingeniería industrial) / Manuel Cortés Cherta, Juan Corrales Martín, Alfonso Enseñat Badía. - 3ª ed., 1ª reimp Madrid: Universidad Nacional de Educación a Distancia, 2002.
- \* Irwin, J. David. Análisis básico de circuitos en ingeniería / J. David Irwin; traducción, Ricardo Cruz Quintana; revisión técnica, Bernard Roeland Van Der Mersch Huerta Romo. 1ª ed. en español México [etc.]: Prentice-Hall Hispanoamericana, cop. 1997.
- \* Mendoza Villena, Montserrat. Problemas de análisis de circuitos eléctricos: corriente continua. Corriente alterna monofásica / Montserrat Mendoza Villena, Luis Alfredo Fernández Jiménez Logroño: Universidad de La Rioja, Servicio de Publicaciones, D.L. 1997.
- \* Teoría de circuitos / preparada por Valentín M. Parra Prieto [et al.]. 7ª ed., 9ª reimp. Madrid: Universidad Nacional de Educación a Distancia, imp. 2002.
- \* Teoría de circuitos: ingeniería industrial / preparada por Valentín Parra Prieto [et al.]. [7a. ed; 4a. reimp.] Madrid: Universidad Nacional de Educación a Distancia, 1996 [tomo II].

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\* Clarià Sancho, Francisco. Análisis de circuitos / Francisco Clarià. - 1 edc [Lleida]: Paperkite, 2009.

\* Electricidad, teoría de circuitos y magnetismo / Gonçal Fernández Mills, Julián Fernández Ferrer. 2ª ed., reimp. Barcelona: UPC, ETSEIB, 1997.

**Additional material:**

The additional material of the subject (notes of theory, problems, links of interest) can be obtained via Moodle.