30116 - Basic principles of electrical technology

Información del Plan Docente

Academic Year	2018/19
Subject	30116 - Basic principles of electrical technology
Faculty / School	175 - Escuela Universitaria Politécnica de La Almunia 179 - Centro Universitario de la Defensa - Zaragoza
Degree	457 - Bachelor's Degree in Industrial Organisational Engineering 563 - Bachelor's Degree in Industrial Organisational Engineering 425 - Bachelor's Degree in Industrial Organisational Engineering
ECTS	6.0
Year	2
Semester	Second semester
Subject Type	Compulsory
Module	---

1.General information

1.1.Aims of the course

1.2.Context and importance of this course in the degree

1.3.Recommendations to take this course

2.Learning goals

2.1.Competences

2.2.Learning goals

2.3.Importance of learning goals

3.Assessment (1st and 2nd call)

3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

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

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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.

The current subject fundamentals of Electrotechnics 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, in order to make up smaller sized groups.
- **Group Tutorials**: Programmed activities of learning follow-up in which the teacher meets with a group of students to guide their work of autonomous learning and supervision of works directed or requiring a very high degree of advice by the teacher.
- **Individual Tutorials**: Those carried out giving individual, personalized attention with a teacher from the department. Said tutorials may be in person or online.

Defence profile

Ongoing study and effort are essential to achieve the learning outcomes of this course.

The methodology is based on lectures, practical classes with student participation, laboratory sessions. Some individual graded assignments are issued throughout the semester, such as homework, quizzes and other activities, trying to encourage the continued work of students.

4.2.Learning tasks

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

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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:

- **Face-to-face generic activities**:

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

Practical Classes: Problems and practical cases are carried out, complementary to the theoretical concepts studied.

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

- **Generic non-class activities**:

Study and understanding of the theory taught in the lectures.

Understanding and assimilation of the problems and practical cases solved in the practical classes.

Preparation of seminars, solutions to proposed problems, etc.

Preparation of laboratory workshops, preparation of summaries and reports.

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

- **Tutored autonomous activities.**

Although they will have more of a face character have been taken into account in part for their idiosyncrasies, they will be primarily focused on seminars and tutorials under the supervision of the teacher.

- **Reinforcement activities.**

Non-contact marking character, through a virtual learning portal (Moodle) various activities that reinforce the basic contents of the subject be addressed. These activities can be customized or not, controlling their realization through it.

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- Lectures: The topics addressed are the fundamental principles of electrical circuits, the operating principles of their elements, techniques and procedures for circuit analysis and study, and the operating principles of the most common electrical machines, as well as basic selection criteria. Student participation is encouraged.
- Problem classes: In order to illustrate the application of different procedures and techniques presented during the lectures, several problem cases are solved with the active collaboration of students.
- Laboratory sessions: With the aim of achieving a meaningful learning, many of the concepts presented in the lecture sessions are applied in the laboratory. Many working techniques on electrical circuits are exercised in the laboratory, students acquire skills in the use of electrical measuring devices and they also acquire awareness of electrical hazards, being able to implement basic actions to avoid unsafe work conditions.

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- Evaluable Activities: There are two types:
  - Some consist of the resolution by the students, in their study time, of different exercises proposed by the teacher. The correction and marking of these exercises provides information to students about the work that has developed.
  - The second type of assessment activities involves the resolution of brief questionnaires, for a certain time of a lecture session, that require the direct application of concepts to be seeing throughout the semester.

4.3.Syllabus

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The subject is structured around two complementary components contents:
Theorists.
Practical.
THEORETICAL CONTENTS.

The theoretical contents are articulated based on eight teaching units attached relationship, indivisible blocks of treatment, given the configuration of the subject that program. These topics collect the contents needed for the acquisition of predetermined learning outcomes.

- TOPIC 1: Basic electrical concepts.
- TOPIC 2: Direct current.
- TOPIC 3: Single Phase sinusoidal alternating current.
- TOPIC 4: Three phase sinusoidal alternating current.
- TOPIC 5: Single phase transformers.
- TOPIC 6: Three phase transformers.
- TOPIC 7: Direct current motors.
- TOPIC 8: Three phase asynchronous motors.

PRACTICAL CONTENTS.

Those workshop to be developed in the laboratory, which will be performed by students in sessions of one hour below.

- WORKSHOP 1: Measurement Resistance.
- WORKSHOP 2: Measurement capabilities.
- WORKSHOP 3: Measurement inductances.
- WORKSHOP 4: Electrical measurements in sinusoidal steady series RLC circuit.
- WORKSHOP 5: Measure Direct current power.
- WORKSHOP 6: Power measurement and power factor correction in a single phase sistem

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Syllabus:

Topic 1: Kirchhoff's Laws.
1.1. Introduction.
1.2. Units.
1.3. Definitions.
1.4. References' polarity.
1.5. Kirchhoff's laws.

Topic 2: Elements of circuits.
2.1. Ideal elements of circuits.
2.1.1. Dipoles.
2.1.2. Quadripoles.
2.2. Real elements of circuits.

Topic 3: Power and energy.
3.1. Definitions.
3.2. Energy and power in dipoles.
3.3. Energy and power in quadripoles.

Topic 4: Circuit analysis methods.
4.1. Introduction.
4.2. Operational impedances and admittances.
4.3. Operational impedances and admittances association. Voltage divider and current divider.
4.4. Circuit representations.
4.5. Branch transformations.
4.6. Real source transformations.
4.7. Network circuit analysis methods.
4.7.1. Nodal analysis method.
4.7.2. Mesh analysis method.

Topic 5: Fundamental theorems.
5.1. Introduction.
5.2. Superposition theorem.
5.3. Thevenin's theorem.
5.4. Norton's theorem.

Topic 6: Sinusoidal steady state electric circuit analysis.
6.1. Introduction.
6.2. Sinusoidal voltage generation.
6.3. Sinusoidal waveforms. Properties.
6.4. Circuits supplied with sinusoidal sources.
6.5. Determination of the sinusoidal steady state.

6.6. Complex impedances and admittances. Complex impedances association.
6.7. Passive components in sinusoidal steady state.
6.8. Kirchhoff's Laws in sinusoidal steady state.
6.9. Methods of circuit analysis in sinusoidal steady state.
6.10. Fundamental theorems in sinusoidal steady state.
6.11. Basic circuits in sinusoidal steady state.

Topic 7: Power in sinusoidal steady state circuits.
7.1. Instantaneous power.
7.2. Instantaneous power in basic passive dipoles.
7.3. Power in sinusoidal steady state. Power triangle.
7.4. Complex power in the passive dipoles.
7.5. Power factor.
7.6. Theorems related with power in sinusoidal steady state.
7.7. Power measurement.

Topic 8: Balanced three-phase systems.
8.1. Introduction.
8.2. Generating a three-phase system.
8.3. Wye and delta connections.
8.4. Three-phase systems schemes.
8.5. Voltages and currents in three-phase systems.
8.6. Balanced three-phase systems.

Topic 9: Fundamentals of electric machines. Selection and application.
9.1. Introduction: definition and classification.
9.2. General constitution of a transformer.
9.3. Transformers selection.

4.4.Course planning and calendar

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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

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Lectures	3
Laboratory	1
Others 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.
- 10 hours of laboratory workshop, in 1 or 2 hour sessions.
- 5 hours of written assessment tests, one or two hour per test.
- 90 hours of personal study, divided up over the 15 weeks of the semester.

Written continuous assessment tests are related to the following topics:

- **Written assessment test 1**: Topics 1, 2, 3 y 4.
- **Written assessment test 2**: Topics 5, 6, 7 y 8.

The issues on which the work will be developed will be proposed in the third week, carrying out delivery and exposure before the last two weeks teaching in the course of the signature dates will be specified.

The most significant dates of the continuous evaluation system will be published in moodle during the development of the course.

The dates of the global evaluation test will be published officially in
http://www.eupla.unizar.es/asuntos-academicos/examenes

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Lectures and problem classes, and the laboratory sessions are held according to schedule established by the Centre and available on the website of Centro Universitario de la Defensa (http://cud.unizar.es).

The other activities of the course are announced well in advance through the Moodle platform (http://moodle2.unizar.es).

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4.5.Bibliography and recommended resources

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Resources and materials used in the development of the subject are reflected in the following table:

Material	Format
Topic theory notes Topic problems	Paper/repository
Topic theory notes Topic presentationso Topic problems Related links	Digital/Moodle E-Mail
Software	Pc's laboratorio
Technical manuals	Paper/repository Digital/Moodle
Multimeters ammeters Voltmeters Power Meters Frequency Transformers. Rectifiers Oscilloscopes Single and three phase loads Engines	

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Electrical switchgear	