

Academic Year/course: 2022/23

## 28710 - Electrotechnics

### Syllabus Information

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**Academic Year:** 2022/23

**Subject:** 28710 - Electrotechnics

**Faculty / School:** 175 - Escuela Universitaria Politécnica de La Almunia

**Degree:** 423 - Bachelor's Degree in Civil Engineering

**ECTS:** 6.0

**Year:** 2

**Semester:** Second semester

**Subject Type:** Basic Education

**Module:**

## 1. General information

### 1.1. Aims of the course

The subject and its results respond to the following approaches and objectives:

- Establish an overview of the generation, transport, distribution and consumption of electricity.
- Show the basic concepts of the theory of electrical circuits and the study of the different kind of circuits, based on the analysis of networks, according to the nature of the power supply. Direct Current and Alternating Current in single and three-phase are studied as energy sources.
- Introduce fundamental concepts about the electric power system, classification of networks, as well as types of lines and conductors. The section of the conductors of the electric lines and assess their importance from a technical point of view and without losing sight of economic aspects.
- Show the existing regulations on low and high voltage.

These approaches and objectives are in line with the following Sustainable Development Goals (SDGs) of the United Nations 2030 Agenda (<https://www.un.org/sustainabledevelopment/es/>), in such a way that the acquisition of the course learning outcomes provides training and competence to contribute to their achievement to some degree.

**Goal 4:** Quality Education

**Goal 7:** Ensure access to affordable, reliable, sustainable and modern energy

**Goal 9:** Build resilient infrastructure, promote sustainable industrialization and foster innovation

and, specifically, with the targets:

**4.3** By 2030, ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university.

**4.4** By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship.

**4.7** By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development.

**7.1** By 2030, ensure universal access to affordable, reliable and modern energy services.

**7.3** By 2030, double the global rate of improvement in energy efficiency.

**7.A** By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology.

**9.4** By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities.

### 1.2. Context and importance of this course in the degree

This course is part of the degree in Civil Engineering. It is included within the group of subjects that make up the module called Basic Training and more specifically, connected to Physics studies. It is second year, fourth semester course, with a

teaching load of 6 ECTS credits.

This subject has a strong impact in the acquisition of the skills of the degree, as well as providing with additional useful training in the performance of the functions of the Civil Engineer related to the field of electricity.

The need of the subject within the curriculum of the present degree is more than justified and, ideally, students should have clear concepts about what an electric circuit is, what components it has, as well as the physics that lies behind, that is, the electric and magnetic fields theory, knowledge acquired in previous studies.

### 1.3. Recommendations to take this course

The development of the Electrotechnics course requires putting into practice knowledge and strategies from subjects related to technical drawing, Physics, Chemistry and Mathematics.

In relation to the above, in the first year and, in advance, subjects related to these areas of knowledge are studied, providing the basic concepts to be able to follow the learning process without difficulty.

There are no previous requirements to take this course, although an adequate training base is needed in the areas previously mentioned

## 2. Learning goals

### 2.1. Competences

Generic and specific competences that the student will acquire:

- C10: Fundamental knowledge about the power electric system: power generation, transport network, delivery and distribution, as well as types of lines and conductors. Knowledge of the regulations on low and high voltage.
- G01: Capacity for organization and planning.
- G02: Ability to solve problems.
- G03: Ability to make decisions.
- G04: Aptitude for oral and written communication in the native language.
- G05: Capacity for analysis and synthesis.
- G06: Information management capacity.
- G07: Ability to work as a team.
- G08: Capacity for critical thinking.
- G09: Ability to work in an interdisciplinary team.
- G10: Ability to work in an international context.
- G11: Capacity for improvisation and adaptation to face new situations.
- G12: Leadership aptitude.
- G13: Positive social attitude towards social and technological innovations.
- G14: Ability to think, discuss and present ideas.
- G15: Ability to communicate through words and images.
- G16: Ability to search, analyze and select information.
- G17: Capacity for autonomous learning.
- G23: Learn and understand the respect for fundamental rights, equal opportunities for women and men, universal accessibility for people with disabilities, and respect for the values of the culture of peace and democratic values.
- G24: Encourage entrepreneurship.
- G25: Knowledge of information and communication technologies.

### 2.2. Learning goals

To pass this subject, students must show that they have achieved the basic fundamentals of electrotechnics and their application in Civil Engineering, with an ability to:

? Classify, analyze, calculate and design the use of direct and alternate current electrical circuits in single and polyphase systems.

? Analyze, calculate and design energy needs, electrical power and its distribution in civil works.

? Design, calculate and define, from the technical, scientific and social points of view, the production, transformation and distribution of electrical energy.

? Identify, analyze and justify a lighting installation to meet the needs of civil works.

? Identify, interpret, calculate, design and justify the elements of maneuver, measurement, protection and safety in electrical installations of civil works.

### 2.3. Importance of learning goals

This subject has a remarkable engineering nature, that is, it offers training with application contents and immediate development in the labor and professional market. Through the achievement of the relevant learning results, the student will understand the operation of circuits and power lines, which will be absolutely essential for the design and implementation of any applications, plants, processes, etc. included within the scope of Civil Engineering.

### 3. Assessment (1st and 2nd call)

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

To pass the subject, the student must demonstrate that they have achieved the expected learning results through any of the following procedures:

##### 3.1.1 CONTINUOUS ASSESSMENT

Students must attend at least 80% of the classes (lectures, practice sessions, technical visits, etc.)

The continuous evaluation system will have the following group of gradable activities:

##### VISITS and / or TECHNICAL TALKS

If there were any, they would be a necessary requirement to be qualified through continuous evaluation.

##### LABORATORY PRACTICE TASKS

Practice activities belonging to each of the knowledge areas will be carried out. These will be used to understand and apply the concepts studied. Each student must carry out the practice tasks individually.

During the practice sessions, the student will have to produce a report of the practice activities that will include the calculations and analyses prior to their production, comparing this analysis with the measurements made in the laboratory and showing the correct operation. In addition, it must include the methodology followed during the practice sessions. The above-mentioned report must be delivered at the end of the continuous assessment. The corresponding part of the report may be requested after one week of the practice activity.

Laboratory practices will weigh 10% of the final grade of the course. Being a necessary requirement to be graded through continuous assessment.

If any students could not attend the practical classes in a justified manner or could not reach the minimum to be graded in one of the practice activities, an extraordinary session will be offered so that the failed practice tasks can be carried out or completed to pass the subject.

##### ASSIGNED WORK

The teacher will assign different tasks to be done individually.

They will be mandatory and their report will be assessed. Students will have to do a public presentation. This activity will weigh up to 25% to the final grade of the course. To take this grade into account, the work must be delivered on the dates set. In case they are not delivered in time and form they will be graded with a 0.

##### WRITTEN ASSESSMENT TESTS

They will be taken to regulate the distribution of effort over time. These tests will include theoretical and / or practical questions on the different issues to be assessed. There will be between four and / or five tests throughout the semester. This activity will weigh 65% in the final grade of the course.

They will consist of the typical written exams, with a score between 0 and 10 points. The final grade of this activity will be the result of the arithmetic average of these tests, as long as there are no unit grades below 4 points. In this case the activity will be failed. The approach and the correct resolution will be valued, as well as the justification of the methodology used when solving the exercises.

The following table serves as a summary of the above:

Continuous assessment system activities	Weight
Laboratory practice tasks	10%
Assigned work	25%
Written tests	65%

Prior to the first official call, the teacher will notify each student whether or not they have passed depending on the use of the continuous assessment system, based on the sum of the scores obtained in the different activities developed, each contributing with a minimum of 40%. In case of not passing in this way, the student will have two additional calls (global assessment tests). On the other hand, students passing the subject through this system, may also opt for the global assessment test, first call, to improve their grades.

##### 3.1.2 GLOBAL TEST

In the event that the student does not opt for the continuous assessment system, for whatever reasons and following the regulations of the University of Zaragoza in this regard, a global test will be scheduled for both laboratory practice tasks and a written exam. Students who opt for the global assessment test must carry out the following gradable activities:

##### LABORATORY PRACTICE WORK

It will consist of a test in which the student must solve in the laboratory a series of exercises of a similar level to the practice work carried out during the continuous assessment system that will be assessed from 0 to 10. Both the theoretical justification of the exercise and the results obtained during the practice work must be delivered. It will weigh 10% of the value

of the final grade.

#### ASSIGNED WORK

The student will have to deliver the assigned tasks during the course, carried out individually, one week before the global test. Both the tasks presented and their possible public presentation / defense will be assessed. It will weigh 25% of the value of the final grade.

#### WRITTEN ASSESSMENT TEST

This test will be unique with theory and exercises weighing 65% to the final grade for the course. It will consist of solving theoretical and / or practical application exercises with similar characteristics to those done during the normal development of the course.

As a summary of the above, the following weighing table of the grading process of the different activities has been designed in which the global assessment test of the subject has been structured.

Activities of the assessment system by test	Weight
Laboratory practice tasks	10%
Assigned work	25%
Written tests	65%

The subject will have been passed if the sum of the scores obtained in the different activities carried out is equal or greater than 50%, each contributing with a minimum of 40%.

For those students who have failed the continuous assessment system but have completed some of their activities, except for the written assessment tests, they may be promoted to the global assessment test, and it may be the case that they only have to take the written exam.

All the activities in the global assessment test, with the exception of the written exam, may be promoted to the next official call, within the same academic year.

The assessment criteria to be followed for the global test activities will be the same as those defined for the continuous assessment system, taking into account that the written exam will consist of one or two exercises for each block.

## 4. Methodology, learning tasks, syllabus and resources

### 4.1. Methodological overview

A strong interaction between the teacher/student is promoted. The methodology followed in this course is oriented towards the achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as:

- Theory sessions: Lectures intended to explain the theory concepts of the subject, highlighting the fundamentals, structuring them in topics and / or sections and relating them to each other.
- Practice sessions: The teacher solves problems or practical cases. This type of teaching complements the theory presented in the lectures with practical aspects.
- Laboratory sessions: The class will be divided into smaller groups, depending on the number of students enrolled. The students will carry out tests, measurements, assemblies, etc. in the laboratories in the presence of the internship teacher.
- Group tutorials: Scheduled learning follow-up activities in which the teacher meets with a group of students to guide their autonomous learning tasks and to supervise assigned work.
- Individual tutorials: These are carried out through personalized attention. They aim to help solve the doubts that the students may come across, particularly those who for various reasons cannot attend group tutorials or need more personalized attention. These tutorials may be face-to-face or virtual.

The approach, methodology and assessment of this guide are intended to be the same for any teaching scenarios. They will be adapted to the social-health situation at any particular time, as well as to the instructions given by the authorities concerned.

### 4.2. Learning tasks

This course is organized as follows:

Generic face-to-face activities:

- Theory sessions: The theoretical concepts of the course are explained and illustrative examples are developed as a support to the theory when necessary.
- Practice sessions: Problems and practical cases are carried out, complementary to the theoretical concepts studied.
- Laboratory sessions. Teachers will supervise students' activities.

Generic non-face-to-face activities:

- Study and assimilation of the theory exposed in the lectures.
- Understanding and assimilation of problems and practical cases solved in practical classes. Preparation of seminars, resolution of assigned problems, etc.
- Preparation of laboratory practice activities, preparation of scripts and corresponding reports. Preparation of written continuous assessment tests and final exams.

Autonomous tutored activities.

They will rather have a face-to-face nature, and they will be mainly focused on seminars and tutorials under the supervision of the teacher.

Reinforcement activities.

With a rather non-face-to-face nature, different activities that reinforce the basic contents of the subject will be carried out through a virtual teaching portal (Moodle). These activities may be personalized or not.

### 4.3. Syllabus

This course will address the following topics:

#### THEORY

- TOPIC 1: Basic electrical concepts.
- TOPIC 2: Electric layouts. Protection and control elements.
- TOPIC 3: Generation, transportation and distribution of electric power.
- TOPIC 4: Commissioning Work
- TOPIC 5: Basics of sinusoidal single phase alternating current.
- TOPIC 6: Basic sinusoidal alternating circuits.
- TOPIC 7: Three-phase sinusoidal alternating current
- TOPIC 8: Calculation of single-phase and three-phase lines
- TOPIC 9: Lighting

#### PRACTICE

These workshops to be developed in the laboratory will be performed by students in sessions of one hour.

- WORKSHOP 1: Introduction to laboratory instrumentation.
- WORKSHOP 2: DC Circuits
- WORKSHOP 3: AC Circuits
- WORKSHOP 4: Lighting.

### 4.4. Course planning and calendar

The course has 6 ECTS credits, from which 150 hours account for student work during the semester, that is, 10 hours per week during 15 teaching weeks.

The time distribution for a teaching week is as follows:

? 45 hours of lectures, with 40% theoretical presentation and 60% resolution of standard problems.

? 10 hours of laboratory practice activities, in sessions of 1 or 2 hours.

? Hours of written assessment tests, with one or two hours per test.

? 90 hours of personal study of the student, throughout the 15 weeks of the semester.

The written tests of the continuous assessment, laboratory practice tasks and assigned works will be related to the topics as follows:

UNIT 1	UNIT 2	UNIT 3	UNIT 4	UNIT 5	UNIT 6	UNIT 7	UNIT 8	UNIT 9
WORK	WORK	WORK	WORK	WORK				WORK
TEST 1 and 2				TEST 3	TEST 4		TEST 5	
LAB 1	LAB 2			LAB 3				LAB 4

The report on the laboratory practice activities must be delivered at the end of the continuous assessment.

The assigned work will be delivered the day before their public oral presentation. The calendar will be explained during the first weeks.

The dates of the written tests of the continuous assessment will be agreed upon with the students.

The dates of the global assessment tests will be officially published in:

<https://eupla.unizar.es/asuntos-academicos/examenes>

The weekly schedule of the subject will be officially published in:

<http://www.eupla.unizar.es/asuntos-academicos/calendario-y-horarios>

#### **4.5. Bibliography and recommended resources**

<http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=28710>