VNIVERSITAT DE VALÈNCIA

Course Guide
34933 Electrical technology / electrotechnics

COURSE DATA

Data Subject	
Code	34933
Name	Electrical technology / electrotechnics
Cycle	Grade
ECTS Credits	6.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
1404 - Degree in Industrial Electronic Engineering	School of Engineering	2	First term

Subject-matter

Degree	Subject-matter	Character
1404 - Degree in Industrial Electronic Engineering	15 - Electrotechnics	Obligatory

Coordination

Name	Department
FERRERES SABATER, AGUSTIN	242 - Electronic Engineering

SUMMARY

This is a mandatory course taught in the first semester of the second year of the degree of Bachelor in Industrial Electronics Engineering. The total teaching load is 6 ECTS. The workload for the student is 150 hours over the semester, 60 of which correspond to classroom lectures and 90 correspond to home assignments.

This subject is part of the matter Electrical Technology together with the subject Electrical Machines. This is a subject that should provide the student with a global vision and practice of electricity as a source of energy available by the end user and the management and use of energy according to the established legal standards.

This course addresses the basic principles of generation, distribution and management of electric power. It will give the student the knowledge and application of technical concepts that apply to electrical installations in medium and low voltage. It will also provide students with the necessary general

knowledge and methods for solving engineering problems.

The basic contents of the subject are:

• Generation and distribution of electricity.

• Transformation centers.

• Low voltage switchgear.

• Ground connections.

• Protection of people against direct and indirect contacts with the grid.

• Busbar.

• Facility protections against overcurrent and overvoltage.

• Lighting systems.

• Rates and reactive power compensation.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

The background needed for the subject is acquired in the subjects of mathematics taught in first and second semester. This knowledge includes calculations with complex numbers, Laplace transform and Fourier analysis. Other essential contents necessary to successfully pass the course are the electric circuits theory and to a lesser extent basic analogue electronics.

OUTCOMES

1404 - Degree in Industrial Electronic Engineering

- CG3 - Knowledge of basic and technological subjects that allows students to learn new methods and theories and provides them with versatility to adapt to new situations.

- CG4 - Ability to solve problems with initiative, decision-making skills, creativity and critical reasoning and to communicate and transmit knowledge, abilities and skills in the field of industrial engineering (with specific industrial electronics technology).
- CG6 - Ability to deal with specifications, regulations and mandatory standards.
- CE1 - Applied knowledge of electrical engineering.

LEARNING OUTCOMES

The result of learning having completed the course in Electrical Technology is summarised in the following capabilities:

• Understanding the generation and distribution of electric power. (CG3, CG6, CE1)

• Be able to specify and size the elements of electrical installations in buildings and industrial plants. (CG4, CG6, CE1)

• Understand the existing regulations on electrical installations. (CG6, CE1)

• Be able to calculate the protections against direct and indirect contacts of humans to hot conductors, and protections against overvoltage and overcurrent. (CG4, CG6, CE1)

• Know the residential and industrial applications of electricity for the correct sizing of the facilities. (CG3, CG4, CG6, CE1)

After having completed the course Electronic Technology, the student must have acquired a number of skills. The student should be able to:

• Know the concepts and elements associated with the generation of electricity.

• Describe how electricity is transmitted and distributed.

• Describe the functions of the switchgear.

• Know the switchgear and protection circuits used in an electrical installation.

• Select switchgear and circuit-protection devices for any type of installation.

• Describe the grounding system

• Know the safety rules associated with grounding.

• Design the grounding of low voltage electrical installations.

• Identify the dangers of electricity and deduct safety rules.

• Express the concepts of direct and indirect contact to the hot line.

• Establish and interpret the functioning of protection systems against direct and indirect contacts to the hot line.

• Recognise and differentiate the different types of cables and select a cable installation that fulfils the requirements.

• List and define the basic concepts related to overloading.

• Select the devices for overload protection.

• Understand basic concepts related to short circuits.

• Design protection elements against an electrical short circuit.

• Understand the magnitude and units in lighting installations.

• Design lighting installations.

• Analyse the problem of reactive power in electrical installations.

• Know the methods and equipment for reactive power compensation.

• Supervise low voltage installations and confirm that established regulations are fulfilled.

• Design a low voltage installation.

• Know the types and elements of a customer distribution transformer.

In addition to the specific objectives mentioned above, the course will encourage the development of various social skills and techniques, which include:

• Ability to analyse an engineering problem and find the optimal solution.

• Ability to organize and plan the course.

• Appropriate use of scientific and technical terms.

• Communication skills in formal writing and understandable to other engineers.

• Ability to time managing.

• Decision-making.

• Ability to work in a multidisciplinary team.

• Ability to work in an international context.

• Ability to communicate with experts in other areas.

• Skills in interpersonal relationships.

• Critical reasoning.

• Ethical commitment.

• Ability to apply knowledge acquired in the course to real life.

• Ability to learn and work independently.

• Adapting to new situations.

• Creativity. Ability to explore new solutions.

• Leadership. Initiative and entrepreneurial spirit.

• Capacity of overcome previously unknown problems.

DESCRIPTION OF CONTENTS

1. Power generation systems

Presentation.
Calendar.
Introduction.
Structure of an electrical system.
Hydroelectric power plant.
Conventional thermal power plants.
Nuclear power plants.
Renewable energy plants.
Cogeneration.

2. Transport and distribution of electricity

Review the concepts of single and three phase alternating current.
Electrical power.
Elements involved in the transport and distribution of electricity.
Symbology.
Transformer.
Distribution networks.
Parameters of the power lines.

3. Low voltage switchgear

Introduction. Definitions and Magnitudes.
Circuit Breakers.
Small circuit breakers.
Fuses.
Contactors.
Differential switches and relays.

4. Electrical Raceways

Introduction.
Structure of insulated cables.
Applications of cables.
Electrical parameters of the conductors.
Voltage drop in conductors.
Heating of the conductors.
Baseline data for conductor sizing.
Sizing of conductors.

5. Overload and short circuit protection

Introduction.
Overload protection.
Short circuit protection.
Calculation of short circuit currents in low voltage installations.
Selection of devices for protection against short circuits.
Overvoltage protection.

6. Ground connections

Introduction.
Characterization parameters of a ground connection.
Purpose of grounding electrical systems.
Distribution patterns at low voltage.
Calculation of resistance of a grounding connection.

7. Protection against direct and indirect contacts to hot lines

Introduction.
Danger of electric current.
Concept of direct and indirect contact to the hot line.
Protection against direct contact.
Protection against indirect contact.

System protections against indirect contacts based on power failure.
Other system protections against indirect contacts without cutting the power.

8. Power Quality. Reactive power compensation in low voltage installations

Introduction.
Need for compensation.
Forms of compensation.
Reactive power demand of different consumer items.
Calculation of reactive power to compensate.
Determination and calculation of the capacitors to be used.
Automatic adjustment of reactive power.

9. Transformer substation

Transformer substation.
Introduction.
Open-air transformer substation.
Indoor transformer substations.
Design of pipelines.
Switchgear and equipment of a transformer substation.

10. Industrial and residential electricity. Lighting

Introduction.
Quantities and units.
Elements of lighting installations.
Types of lamps.
Facility Design.
Lighting.
Lighting and energy saving.

11. Design example of a facility

Calculation of transformer substation.
Switchgear installation.
Grounding scheme.
Protections.
Type and size of the wiring.

12. Legal Framework. Procurement of electricity

Introduction.
Structure and actors in the market.
Qualified consumers.
Consumers to rate.
Rights and obligations of consumers

13. Electrical Technology Lab

Software tools. AC measurements and instrumentation.
Simulations of lines, and transient protection.
Energy, power and power factor measurements. Power factor correction.
Real life applications
Low voltage systems. Grounding method.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	25,00	100
Classroom practices	20,00	100
Laboratory practices	15,00	100
Development of group work	10,00	0
Study and independent work	15,00	0
Readings supplementary material	5,00	0
Preparation of evaluation activities	33,00	0
Preparing lectures	10,00	0
Preparation of practical classes and problem	15,00	0
Resolution of online questionnaires	2,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

Class work: Theory, exercises and laboratory.

Theory means the amount of time the teacher meets the students to develop theoretical concepts. During these classes the teacher will introduce the theoretical concepts using different methods that can change depending on the unit. (CG3, CG6, CE1)

Exercises means the amount of time the teacher and students solve practical problems. During these

classes students will solve practical problems and issues with the assistance of teachers. They promote the exchange of ideas between students and the common search for solutions. (CG4, CG6, CE1)

Classes are understood as the time spent in the lab. During these classes students have software tools and electrical equipment to verify experimentally the theoretical concepts as well as the opportunity to confirm the solutions of the problems. (CG4, CG6, CE1)

Student's homework: Preparation of classes, problem solving, job preparation, prior preparation of the laboratory sessions and reporting.

Preparation of Class: Refers to the individual study to be carried out prior to the classes to understand what is going to be explained in the class and prepare questions.

Troubleshooting: Time used by the student to perform some of the exercises proposed by the teacher. Some of these exercises will be discussed in the class.

Preparation of work assignment: time used by the student for individual and group work proposed by the teacher.

Preparation of the lab sessions and reports of the lab sessions: It is the time that students devote to understanding the lab assignments. It also includes the time taken to make the report of work done in the previous lab session.

During the homework activities the student develops all the competences of the subject (CG3, CG4, CG6, CE1)

Tutorials.

The tutorial is twofold, firstly, it should serve primarily for students to plan its method of study and, moreover, the teacher has a feedback method to test the effectiveness of the educational method. Tutorials also serve to clarify technical questions related to any part of the course.

EVALUATION

CONTINUOUS ASSESSMENT

The evaluation consists of taking tests throughout the semester. Three types of tests are proposed: CONTROLS, WORKS and QUESTIONNAIRES. With these tests all the skills of the subject are evaluated. (CG3, CG4, CG6, CE1).

- CONTROL (30% of the final grade): Individual tests with content of theory and problems. To be able to eliminate the evaluated subject and exclude it from the exam of the 1st call, the score of the test must be greater than or equal to 5.

- WORKS AND QUESTIONNAIRES (15% of the final grade): contains both face-to-face and non-face-to-face work / exercises, both in groups and individually.

EVALUATION OF THE PART OF THE PRESENTIAL LABORATORY (10% of the final grade). The mark will be the weighted average of those practices for which a study or report had been requested

Attendance at laboratory practices is mandatory, and in order to add the mark of the practice reports to the final mark of the course, you must attend at least 80% of the practices, in addition, a minimum grade of 4 must be obtained in the reports. These condition is necessary to take the Continuous Assessment method and therefore to be able to pass the subject in the 1st Call. The face-to-face activity of laboratory practices is considered non-recoverable.

ASSESSMENT of the SUBJET in first CALL

As a continuation and end of the continuous evaluation in the 1st call, there will be an examination of the parts of the subject not yet evaluated or pending to be passed. The exam will consist of the following parts.

Test with contents of theory, problems and laboratory exam (45% respectively of the final grade) or (75% respectively of the final grade if the CONTROL was not passed). To compensate with the continuous assessment the score of the test must be greater than or equal to 5.

To pass the course, the weighted average of the TOTAL of the course must be greater than or equal to 5 out of 10.

ASSESSMENT of the SUBJET in Second CALL

For all the students, having participated or not in the continuous assessment, the evaluation of the subject will do by means of a final examination ALL the contents of the subject.

Will take into account the DELIVERABLES and QUESTIONNAIRES made along the course. If these have not been done during the continuous evaluation the weight in the final mark of this part passes to the “ONLY ONE” exam.

The contributions of each part to the final note of the subject are:

Examination 7,5 -- 9 Points on 10

DELIVERABLES and QUESTIONNAIRES 1,5 points on 10 (if performet)

Sessions of laboratory 1 point on 10 (if performed)

To be able to averaging with the weights indicated in the previous paragraph the note of the examination has to achieve a minimum of 5 out of 10. The subject surpasses with a final note of at least 5 points on 10.

In any case, the evaluation system shall be governed by the following document: Reglament de Avaluació i Qualificació de la Universitat de València per a Graus i Màsters

(https://webges.uv.es/uvTaeWeb/MuestraInformacionEdictoPublicoFrontAction.doaccion=inicio&idEdictoSeleccionado=5639)".

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