



Universitat de Lleida

DEGREE CURRICULUM

# USE OF ELECTRICAL ENERGY

Coordination: GREGORIO LOPEZ, EDUARD

Academic year 2022-23

## Subject's general information

<b>Subject name</b>	USE OF ELECTRICAL ENERGY			
<b>Code</b>	102146			
<b>Semester</b>	1st Q(SEMESTER) CONTINUED EVALUATION			
<b>Typology</b>	<b>Degree</b>	<b>Course</b>	<b>Character</b>	<b>Modality</b>
	Bachelor's Degree in Energy and Sustainability Engineering	3	COMPULSORY	Attendance-based
	Double bachelor's degree: Degree in Mechanical Engineering and Degree in Energy and Sustainability Engineering	3	COMPULSORY	Attendance-based
<b>Course number of credits (ECTS)</b>	6			
<b>Type of activity, credits, and groups</b>	<b>Activity type</b>	PRALAB	PRAULA	TEORIA
	<b>Number of credits</b>	0.6	2.4	3
	<b>Number of groups</b>	2	1	1
<b>Coordination</b>	GREGORIO LOPEZ, EDUARD			
<b>Department</b>	AGRICULTURAL AND FOREST ENGINEERING			
<b>Teaching load distribution between lectures and independent student work</b>	40% at class, 60% autonomous work. See the "Development plan".			
<b>Important information on data processing</b>	Consult <a href="#">this link</a> for more information.			
<b>Language</b>	English			

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
GREGORIO LOPEZ, EDUARD	eduard.gregorio@udl.cat	6,6	To arrange.

## Subject's extra information

This subject presents a broad overview of different applications of electrical technology: electrical machines, electrical installations, lighting, electric vehicles. Key concepts such as electrical power quality, efficiency and reactive compensations are also introduced. Together with the subject Electrical Power Systems, it is part of the specific training about Electrical Energy.

It is **COMPULSORY** that the students bring the following elements of individual protection (EPI) to the practices at the laboratory.

- Laboratory gown from UdL (unisex)
- Protection glasses
- Mechanical protection gloves

They can be purchased through the shop Údels of the UdL:

C/ Jaume II, 67 baixos  
Centre the Cultures i Cooperació Transfronterera

<http://www.publicacions.udl.cat/>

The use of other elements of protection (for example caps, masks, gloves of chemical or electrical risk, etc.) will depend on the type of practice to be done. In that case, the teacher will inform of the necessity of specific EPI.

Not bringing the EPI's described or not fulfilling the norms of general security that are detailed below imply that the student can not access to the laboratories or have to go out of them. The no realisation of the practices for this reason imply the **consequences in the evaluation** of the subject that are described in this course guide.

## GENERAL NORMS OF SECURITY IN LABORATORY PRACTICES

- Keep the place of realisation of the practices clean and tidy. The table of work has to be free from backpacks, folders, coats...
- No short trousers or short skirts are allowed in the laboratory.
- Closed and covered footwear is compulsory in the laboratory.
- Long hair needs to be tied.
- Keep the laboratory gown laced in order to be protected from spills of chemicals.
- Bangles, pendants or wide sleeves are not allowed as they can be trapped.
- Avoid the use of contact lenses, since the effect of the chemical products is much bigger if they enter between the contact lense and the cornea. Protection over-glasses can be purchased.
- No food or drink is allowed in the laboratory.
- It is forbidden to smoke in the laboratories.
- Wash your hands whenever you have contact with a chemical product and before going out of the laboratory.
- Follow the instructions of the teacher and of the laboratory technicians and ask for any doubt on security.

For further information, you can check the following document of the *Servei de Prevenció de Riscos Laborals de la UdL*: <http://www.sprl.udl.cat/alumnes/index.html>

## Learning objectives

This subject presents the key elements responsible for the conversion and consumption of electrical energy. The specific objectives of this subject are:

- Select the most suitable electrical machine for each application.
- Identify the different types of electronic power converters.
- Design low-voltage installations
- Select and calculate the different types of electrical protection systems.
- Recognize and quantify the quality and efficiency in the use of electrical energy.
- Know the main electric lighting technologies.
- Know the main technologies involved in electric vehicles.

## Competences

### Basic

- CB2. That students know how to apply their knowledge to their work or vocation in a professional way and possess the skills that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study.
- CB3. That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include a reflection on relevant issues of a social, scientific or ethical nature.
- CB5. That the students have developed those learning skills necessary to undertake further studies with a high degree of autonomy.

### General

- CG10. To have knowledge and use of the principles of circuit theory and electrical machines.
- CG11. To have knowledge of the fundamentals of electronics.

### Specific

- CE5. To have the capacity to calculate and design electrical machines.
- CE6. To have the capacity to calculate and design low and medium voltage electrical installations.
- CE7. To have the capacity to calculate and design power lines and transport of electrical energy.
- CE8. To have knowledge about electrical power systems and their applications.
- CE9. To have applied knowledge of power electronics.
- CE11. To have the capacity to design power plants.
- CE13. Acquire knowledge and capacity for modeling and simulation of systems.

### Cross-disciplinary

- CT2. Master a foreign language, especially English.
- CT3. Acquire training in the use of new technologies and information and communication technologies.

## Subject contents

- Unit 1. Electric machinery.
- Unit 2. Low-voltage installations.
- Unit 3. Lighting technology.
- Unit 4. The electric vehicle.

## Methodology

- **Lectures:** Classes to explain the theory and problem solving.
- **Resolution of problems:** Students solve problems individually during these sessions under the supervision of the teachers.
- **Delivery of exercises:** Students deliver exercises proposed by the teacher (to solve in class or at home), who corrects and returns it to the student.
- **Laboratory:** operation and control of electrical machines using the equipment available in the lab. It is imperative that students take the PPE indicated in each lab class and follow the risk prevention rules specified in each case.
- **Exam:** Two exams are held during the semester. There is also a final retrieval test.

## Development plan

The following plan may be subject to change depending on the number of students and the evolution of the group.

Week	Methodology	Contents	Class hours	Hours of autonomous work
1-8	Lectures Resolution of problems Exercises and works	1. Electrical machines	20	32
6-8	Practices	1. Electrical machines	6	6
7-12	Lectures Resolution of problems Exercises and works	2. Low-voltage installations	18	30
9	1st exam (PA1)	1. Electrical machines	2	
12-14	Lectures Resolution of problems Exercises and works	3. Lighting technology	8	14
14-15	Lectures Resolution of problems	4. Electrical vehicles	4	8
16-17	2nd exam (PA2)	2. Low-voltage installations 3. Lighting technology 4. Electrical vehicles	2	
19	Recovery exam	All the contents of the subject	2	

## Evaluation

Evaluation activities	%	Dates
PA 1. Exam (unit 1)	30	Week 9
PA 2. Exam (units 2, 3 and 4)	45	Weeks 16 and 17
Exercises and practices	25	Along the course
Recovery exam	75	Week 19

## Guidelines for evaluation of the subject.

- To pass the course it is necessary at least a grade of 5 over 10 of the final grade

### Exams:

- In the 9th and 16/17th weeks the scheduled exams will be performed (PA1 and PA2). Exam PA1 has a weight of 30% and exam PA2 has a weight of 45% over the final grade of the course.
- The scheduled examens (PA1 and PA2) can be recovered by completing an exam of each part or a joint exam of both parts (19th week).

### Exercises and practices

- During the course it will be proposed several exercises to solve that must be delivered on the established date.
- During the course, it will be conducted several lab practices. The lab reports must be delivered on the established date.
- The exercises and practices grade represents the 25% of the final grade of the course.
- The exercises and practices grade can not be recovered by performing other recovery activities.

## Bibliography

### Basic bibliography

- Stephen J. Chapman, 2012. *Máquinas Eléctricas*. 5a edición, McGraw-Hill, 502 pp.
- Jesús Fraile Mora, 2008. *Máquinas Eléctricas*. 6a edición, McGraw-Hill, 832 pp.
- José Roger Folch, Martín Riera Guasp, Carlos Roldán Porta, 2010. *Tecnología Eléctrica*. Ed. Síntesis. 395 pp.
- José Roger Folch, Martín Riera Guasp, Carlos Roldán Porta, 2014. *Problemas de Tecnología Eléctrica*. Ed. Síntesis. 278 pp.
- Ministerio de Ciencia y Tecnología, 2002. *Reglamento electrotécnico para baja tensión e instrucciones técnicas complementarias*. Real Decreto 842/2002, de 2 de agosto; BOE del 18 de septiembre de 2002 (suplemento).

### Complementary bibliography

- Manuel Pérez Donsión, 2016. *Calidad de la Energía Eléctrica*. Ed. Garceta. 994 pp.
- Fermín Barrero González, et al., 2012. *Fundamentos de Instalaciones Eléctricas*. Ed. Garceta. 260 pp.
- Ana Pozo Ruz, Eva Molero Piñeiro, 2013. *El Vehículo Eléctrico y su Infraestructura de Carga*. Ed. Marcombo. 168 pp.