



Universitat de Lleida

DEGREE CURRICULUM

USE OF ELECTRICAL ENERGY

Coordination: GREGORIO LÓPEZ, EDUARD

Academic year 2019-20

Subject's general information

Subject name	USE OF ELECTRICAL ENERGY			
Code	102146			
Semester	1st Q(SEMESTER) CONTINUED EVALUATION			
Typology	Degree	Course	Character	Modality
	Bachelor's Degree in Energy and Sustainability Engineering	3	COMPULSORY	Attendance-based
Course number of credits (ECTS)	6			
Type of activity, credits, and groups	Activity type	PRAULA	TEORIA	
	Number of credits	3	3	
	Number of groups	1	1	
Coordination	GREGORIO LÓPEZ, EDUARD			
Department	AGRICULTURAL AND FOREST ENGINEERING			
Important information on data processing	Consult this link for more information.			
Language	English			
Distribution of credits	40% at the classroom, 60% autonomous work. See the "Development plan".			

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
GREGORIO LÓPEZ, EDUARD	eduard.gregorio@udl.cat	7,2	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 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 electrical lines
- 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. Optimization of electrical energy consumption.
- Unit 4. The electric vehicle.

Methodology

- **Lectures:** Classes to explain the theory and problem solving on the blackboard.
- **Resolution of problems:** Students solve problems individually during these sessions under the supervision of teachers of the subject.
- **Simulation:** design and simulation of low-voltage installations and lighting systems using specific software.
- **Laboratory:** assembly 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 written tests are held during the semester. There is also a final retrieval test.

Development plan

Week	Methodology	Contents	Hours at classroom	Hours of autonomous work
1-5	Lectures Resolution of problems	1. Electrical machines	14	21
5-6	Laboratory	1. Electrical machines	4	8
6-10	Lectures Resolution of problems	2. Low-voltage installations	12	18
9	1 ^a test of evaluation (exam)	1. Electrical machines	2	
11	Computer practices	2. Low-voltage installations	2	4
11-14	Lectures Resolution of problems	3. Optimization	8	12
12	Laboratory	3. Optimization	2	4
14	Computer practices	3. Optimization	2	4
15	Lectures Resolution of problems	4. Electrical vehicles	4	6
16 i 17	2nd test of evaluation (exam)	2. Low-voltage installations 3. Optimization 4. Electrical vehicles	2	
19	Retrieval exam	All the contents of the subject	2	

Evaluation

Evaluation activities	%	Dates
PA 1. Written exam (unit 1)	32.5	Week 9
PA 2. Written exam (units 2, 3 and 4)	47.5	Weeks 16 and 17
Reports and Practises	20	Along the course
Retrieval exam	80	Week 19

Guidelines for evaluation of the subject.

Exams:

- In the 9th and 16/17th weeks the scheduled exams will be performed (PA1 and PA2). Exam PA1 has a weight of 32.5% and exam PA2 has a weight of 47.5% over the final grade of the course.
- To pass the course it is necessary at least a grade of 5 over 10 of the final grade and simultaneously, to have a grade equal to or greater than 3 of each of these exams (PA1 and PA2).
- In the 19th week it is possible to recover/improve the grade of the course by completing a written exam. The student may recover/improve the grade of the two partial exams or only recover/improve one exam. To pass the subject, it is necessary a grade of 5 over 10 of the final grade and simultaneously, to have a grade equal to or greater than 3 of the recoveries of each exam.

Practicals

- Throughout the course there will be different laboratory and computer practices. The practices grade represent the 20% of the final grade for the course.
- Attendance at laboratory practices and the delivery of corresponding reports is mandatory.
- The 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.
- Roger Folch et al., 2010. *Tecnología Eléctrica*. Ed. Síntesis. 395 pp.
- Roger Folch et al., 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.