



Universitat de Lleida

# DEGREE CURRICULUM **RURAL FACILITIES AND ELECTRIFICATION**

Coordination: ROSELL POLO, JOAN RAMON

Academic year 2022-23

## Subject's general information

Subject name	RURAL FACILITIES AND ELECTRIFICATION				
Code	102577				
Semester	2nd Q(SEMESTER) CONTINUED EVALUATION				
Typology	Degree		Course	Character	Modality
	Bachelor's Degree in Agricultural and Food Engineering		3	COMPULSORY	Attendance-based
Course number of credits (ECTS)	6				
Type of activity, credits, and groups	Activity type	PRACAMP	PRALAB	PRAULA	TEORIA
	Number of credits	0.1	0.4	1.5	4
	Number of groups	1	1	1	1
Coordination	ROSELL POLO, JOAN RAMON				
Department	AGRICULTURAL AND FOREST ENGINEERING				
Teaching load distribution between lectures and independent student work	classroom hours: 60 not classroom hours: 90				
Important information on data processing	Consult <a href="#">this link</a> for more information.				
Language	Catalan:				
Distribution of credits	<p>- Unit 1: Low Voltage Electrical Installations (LVEI). Review of alternating currents. Regulations for LVEI. Elements and characteristics of a LVEI. Security of LVEI. Design and calculation of LVEI. The electrical project in LV. Documentation. (1.9 credits)</p> <p>- Unit 2: Electric Machines (EM). General principles of EM. Power converters. DC rotary EM. AC rotary EM. Applications of EM. Protection of EM. Principles of EM automation. (1.5 credits)</p> <p>- Unit 3: Systems for Rural Electrification. Optimizitation of power consumption. Electricity rates. Power lines. Transformers. Generators. Renewable energy. Photovoltaic instalations. Guidelines and techniques for saving and optimization of power consumption. Tariffication and cost of electricity. (1.5 credits)</p> <p>- Unit 4: Electrical installations for air conditioning, lighting and feeding. Heating systems. Cooling systems. Ventilation systems. Lighting systems. Design of lighting installations. Feeding systems. (1.1 credits)</p>				

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
ROSELL POLO, JOAN RAMON	joanramon.rosell@udl.cat	6	

## Subject's extra information

### Subject / matter in the whole curriculum

The course is compulsory within the specialty of Rural and Environmental Engineering, and deals with the electrical facilities and equipment necessary for the development of the activities of the specialty.

### Requirements to take it

#### prerequisites:

Foundations of Rural Engineering

#### recommendations

Regularly consult the Virtual Campus and e-mail

### Information on the transmission and recording of personal data of teachers and students of the University of Lleida as a result of teaching at the UdL facilities and remotely

The University of Lleida informs that, depending on the changes to which it is forced in accordance with the instructions of the health authorities, the mobility provisions or the quality assurance of teaching, it can transmit, record and use the image, voice or, where appropriate, the physical environment chosen by teachers and students, with the aim of teaching at the UdL facilities and at a distance.

In turn, it encourages the people affected so that, in the case of distance teaching, they choose the spaces that have the least impact on their privacy. And, in general, it is recommended to preferably opt for interactions in chat or without activating the camera, when teaching activities are not carried out that, due to their characteristics, require oral or visual interaction.

The person responsible for the recording and use of these personal data is the University of Lleida -UdL- (contact details of the representative: General Secretariat. Plaza de Víctor Siurana, 1, 25003 Lleida; sg@udl.cat; contact details of the data protection officer: dpd@udl.cat).

These personal data will be used exclusively for the purposes inherent to the teaching of the subject. In particular, the recording fulfills the following functions:

- Offer the possibility of accessing content online and, where appropriate, by way of asynchronous training.
- Guarantee access to content for students who, for technological, personal or health reasons, among others, have not been able to participate.
- To constitute a study material for the preparation of the evaluation.

The use of transmitted data and recordings for other purposes, or in areas outside the Virtual Campus, where they will remain archived, in accordance with the intellectual and industrial property policy of all content included on websites owned by the UdL, is absolutely prohibited. .

If any, the recordings will be kept for as long as the person who teaches the subject decides, in accordance with strictly academic criteria, and, at most, they must be eliminated at the end of the current academic year, under the terms and conditions provided in the regulations on conservation and elimination of the administrative documents of

the UdL, and the documentary evaluation tables approved by the Government of Catalonia (<http://www.udl.cat/ca/serveis/arxiu/>).

These personal data are essential to teach the subject, and the definition of the teaching procedures, especially that done remotely, is a power of the UdL within the framework of its right to university autonomy, as provided by the Article 1.1 and Article 33.1 of Organic Law 6/2001, of December 21, on universities. For this reason, the UdL does not need the consent of the people affected by transmitting or recording their voice, the image and, where appropriate, the physical environment they have chosen, for this exclusive purpose, of teaching the subject.

The UdL will not transfer the data to third parties, except in the cases strictly provided for in the Law. The affected persons can access their data; request its rectification, deletion or portability; object to the treatment and request the limitation, provided that it is compatible with the teaching purposes, by means of a letter sent to the address [dpd@udl.cat](mailto:dpd@udl.cat). They can also file a claim addressed to the Catalan Data Protection Authority, through the Authority's electronic headquarters (<https://seu.apd.cat>) or by non-electronic media.

## Learning objectives

Students in overcoming the course should be able to:

**R1:** Understand and acquire a solid understanding of the regulations, the components and characteristics of a low voltage electrical installation. Knowledge and use of the control and protection devices.

**R2:** Design, dimensioning and calculate an electrical installation for rural and agroindustrial application.

**R3:** Achieving a good knowledge of the operation of electrical machines and calculate its characteristic parameters.

**R4:** Achieving a good knowledge and measure the main systems for rural electrification: conventional and alternative. Calculate the transformer and the power lines.

**R5:** Understand and apply techniques for optimizing power consumption and regulations on electric rates. Improve power factor and how to choose the most appropriate electricity tariff.

**R6:** know and design electrical equipment and facilities for animal welfare: HVAC, lighting, feeding.

## Competences

### General competences

At least the following basic competences are guaranteed:

**CG1.** Capacity for the preparation, design, drafting and signing of projects aimed at the construction, alteration, repair, maintenance, demolition, manufacturing, installation, assembly or operation of real or personal property which by its nature and characteristics remain included in the technical characteristic of the agricultural and livestock production (facilities or buildings, farms, rural infrastructure and roads), food industry (extractive industries, fermentation, dairy, canning, fruit and vegetables, meat, fishing, salting and generally any other dedicated to the production and / or processing, preservation, handling and distribution of food) and gardening and landscape (urban green spaces and / or rural, parks, gardens, nurseries, urban trees, etc., sports facilities and public and private environments subjected to landscape recovery).

**CG3.** Ability to lead the execution of the works object of projects relating to agribusiness, farms and green spaces and its buildings, infrastructure and facilities, prevention of risks associated with the implementation and management of multidisciplinary human teams resource management, in accordance with ethical standards.

**CG7.** Knowledge in basic subjects, science and technology to enable continuous learning and an ability to adapt to new situations or changing environments.

**CG8.** Ability to solve problems with creativity, initiative, methodology and critical reasoning.

**CG10.** Ability to research and use of the rules and regulations relating to its scope.

### Specific competences

Ability to learn, understand and use the principles of:

**CEMCR4.** Engineering of facilities. Rural electrification. Drainage and irrigation technology. Hydraulic works and installations. Facilities for health and animal welfare.

**CEMC10.** Technology transfer, understand, interpret, communicate and adopt advances in agricultural field.

## Subject contents

**Unit 1: Low Voltage Electrical Installations (LVEI).** Review of alternating currents. Regulations for LVEI. Elements and characteristics of a LVEI. Security of LVEI. Design and calculation of LVEI. The electrical project in LV. Documentation.

**Unit 2: Electric Machines (EM).** General principles of EM. Power converters. DC rotary EM. AC rotary EM. Applications of EM. Protection of EM. Principles of EM automation.

**Unit 3: Systems for Rural Electrification. Optimization of power consumption. Electricity rates.** Power lines. Transformers. Generators. Renewable energy. Photovoltaic installations. Guidelines and techniques for saving and optimization of power consumption. Tariffication and cost of electricity.

**Unit 4: Electrical installations for air conditioning, lighting and feeding.** Introduction to Lighting. Lighting installation design. Heating systems. Cooling systems. Ventilation systems. Feeding systems.

### Practical activities

Solving exercises and examples in the classroom.

Design of a low voltage electrical installation.

Experimenting characteristics of electrical machines in laboratory .

Visiting an electrical installation.

Visiting a photovoltaic installation.

Design of a photovoltaic installation

Designing a lighting installation.

## Methodology

BLOCS		Lectures and problems volving (hours)		Practices with the computer (hours)	Laboratory practices/visits (hours)	Evaluation (hours)	TOTAL (hours)
		Classroom	Homework	Classroom	Classroom	Classroom	Classroom/ Homework
1	Unit 1						19/24
	Theory and problems solving	14	24	2	1		
	Exam Unit 1					2	
2	Unit 2						14/22
	Theory and problems solving	10	22		4		
3	Unit 3						15/26
	Theory and problems solving	14	26		1		
4	Unit 4						10/18
	Theory and problems solving	6	18	4			
	Exam units 2, 3 and 4					2	

## Development plan

Type of Activity	Content	Objectives	Classroom hours	Accumulated hours	Evaluation	
					Unit	Time (h)
Lecture	Introduction	General overview.	2	2		

# RURAL FACILITIES AND ELECTRIFICATION 2022-23

Lecture	Unit 1. Review of alternating currents	R1 R2	2	4		
Lecture	Unit 1. Regulations for Low voltage electrical installations, LVEI. Elements and characteristics of an LVEI..	R1 R2	4	8		
Lecture and Problems solving	Unit 1. LVEI design and calculation. Section of conductors.	R1 R2	4	12		
Lecture and Problems solving	Unit 1. Security of the LVEI. The electrical project in LV. Documentation.	R1 R2	2	14		
Computer practices	Unit1. Introduction to the Design and computer calculation of an LVEI.	R1 R2	2	16		
Visit	Unit1: Visit to a LVEI	R1 R2	1	17		
Lecture	Unit 2. General principles of Electrical machines (EM).	R3	2	19		
Lecture	Unit 2. Electric power converters Transformers	R3	2	21		
Lecture	Unit 2. DC and AC rotary electrical machines..	R3	5	26		
Lecture	Unit 2. Protection and control of electrical machines	R3	1	27		
Laboratory practices	Unit 2.Electrical machines	R3	4	31		
				33	Unit 1	2
Lecture	Unit 3. Power lines.	R4	3	36		



# RURAL FACILITIES AND ELECTRIFICATION 2022-23

Lecture	Unit 3. Transformation Centers. Generators.	R4	2	38		
Lecture	Unit 3. Renewable energies.	R4	3	41		
Lecture	Tema 3. Instal.lacions fotovoltaiques.	R4	3	44		
Lecture	Unit 3. Electricity efficiency and savings. Electricity rates	R5	3	47		
Computer practices/ laboratory/visit	Tema 3. Energies renovables.	R4	1	48		
Lecture	<u>Unit 4.</u> Electrical installations for air conditioning, lighting and power supply. Introduction to lighting engineering. Lighting installation design	R6	6	54		
Computer practices	Unit 4. Design of a lighting installation	R6	4	58		
				60	Units 2,3 and 4	2
					final recovery Exam	2

## Evaluation

Type of activity	Results of the learning	Procedure	Qualification weight (%)
Unit 1	R1, R2	work: Design of a low voltage electrical installation.	<b>15</b>

Unit 1	R1,R2	Exam	<b>30</b>
Unit 3	R4, R5	Work: Design of a photovoltaic installation	<b>10</b>
Units 2,3 and 4	R3, R4, R5, R6	Exam	<b>35</b>
Unit 4	R6	Work: Design of a lighting installation.	<b>10</b>
<b>Total</b>			<b>100</b>

## Comments:

### Exams

In the exams, the only documentation that will be available is a formulas sheet prepared by the students themselves.

The final grade is the weighted average of all evaluations. The rating of each part must be equal to or greater than 4.

## Bibliography

### Bibliografía básica

Benilde Bueno, Reglamento Electrotécnico para Baja Tensión. Barcelona: Ed. Marcombo 2020.

Forcada F., Babot, D., Vidal, A., Buxadé, C. 2009. Ganado Porcino. Diseño de alojamientos e instalaciones. Ed. Servet.

García Trasancos, J. 2004. *Instalaciones eléctricas en media y baja tensión*. 4ª ed. Madrid: Paraninfo

García Trasancos, J. 2006. *Electrotecnia*. 9ª ed. Madrid: Thomson-Paraninfo. 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).

Luna Sánchez, L *et al.* 2008. *Instalaciones eléctricas de baja tensión en el sector agrario y agroalimentario*. Madrid: Ediciones Mundi-Prensa.

MINISTERIO DE CIENCIA Y TECNOLOGIA. 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).

MINISTERIO DE INDUSTRIA, TURISMO Y COMERCIO. 2008. Real Decreto 223/2008, de 15 de febrero, por el que se aprueban el Reglamento sobre condiciones técnicas y garantías de seguridad en líneas de alta tensión y sus instrucciones técnicas complementarias ITC-LAT.

MINISTERIO DE INDÚSTRIA Y ENERGÍA. 1990. Reglamento sobre Centrales Eléctricas, Subestaciones y Centros de Transformación.

Roger Folch, J., Riera Guasp, M., Roldán Porta, C. 2010. Tecnología Eléctrica (3ª edición) Editorial Síntesis, S.A.

## **Bibliografia complementària**

Rosell J.R. 2000. Circuitos eléctricos monofásicos y trifásicos. Fundamentos teóricos y ejercicios resueltos. Lleida: Ed. Universitat de Lleida.

Rosell J.R. 2022. Circuits elèctrics monofàsics i trifàsics. Fonaments teòrics i exercicis resolts .Material docent no editat.

Martínez F. 2004. Instalaciones eléctricas de alumbrado e industriales. 4ª ed. Madrid: Thomson-Paraninfo.

Sanz J.L. 2005. Instalaciones eléctricas. Soluciones a problemas en baja y alta tensión. Madrid: Thomson-Paraninfo.

Wildi T. 2007. Máquinas eléctricas y sistemas de potencia. 6ª ed. México: Pearson-Prentice Hall.

Barrero González, F., González Romera, E., Milanés Montero, M. I., Romero Cadaval, E. 2012. Fundamentos de Instalaciones Eléctricas. Editorial GARCETA.