



Course guide

205145 - 205145 - Design of Renewable Energy-Based Electrical Systems

Last modified: 26/05/2026

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 709 - DEE - Department of Electrical Engineering.

Degree: MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2025). (Optional subject).

Academic year: 2026 **ECTS Credits:** 5.0 **Languages:** Spanish

LECTURER

Coordinating lecturer: SANTIAGO BOGARRA RODRIGUEZ

Others: JESÚS ALBERTO LÓPEZ - CARLOS LÓPEZ TORRES

PRIOR SKILLS

It is important that the student has acquired the prior competences developed in Physics, Circuit Theory, Electrotechnics and Electrical Machines, related to electromagnetism, electricity, electrical circuit analysis, and the knowledge and use of electrical machines, as well as in Design of Electrical Power Generation, Transmission and Distribution Systems.

LEARNING RESULTS

Knowledges:

KE1. Identify current problems in electrical machines (specialisation in Electrical Engineering).

Skills:

S02. Carry out appropriate calculations for the design of industrial products, processes, installations and plants.

TEACHING METHODOLOGY

The teaching methodology is divided into three parts:

- Face-to-face content delivery sessions, in which the teaching staff introduce the theoretical foundations of the subject, illustrating them with examples that facilitate understanding. The lecturer will guide students in data analysis and problem solving by applying theoretical techniques and concepts.
- Face-to-face practical work sessions involving project development, in which the teaching staff will guide the student in the application of theoretical concepts.
- Autonomous study and project work, in which the student will apply the knowledge acquired in the face-to-face sessions.

LEARNING OBJECTIVES OF THE SUBJECT

.Carry out projects on electrical systems, including energy generation using renewable energy sources.

STUDY LOAD

Type	Hours	Percentage
Hours large group	30,0	24.00
Self study	80,0	64.00
Hours small group	15,0	12.00



Total learning time: 125 h

CONTENTS

Electrical systems project with wind energy.

Description:

1. Types of wind turbines.
2. Assessment of wind energy potential.
3. Energy balance of the wind power system.
4. Sizing of the wind power system.
5. Electrical systems in a wind farm.
6. Sizing of the electrical network.
7. Steady-state operation of the electrical network.

Specific objectives:

The student must be able to:

- Understand the operation of the electrical systems of a wind farm.
- Carry out a project for an electrical system with wind energy.

Related activities:

Projects, midterm exam and final exam.

Full-or-part-time: 63h

Theory classes: 16h

Laboratory classes: 7h

Self study : 40h

Electrical systems project with photovoltaic energy.

Description:

- 1.Characterisation of photovoltaic modules.
- 2.Assessment of solar potential.
- 3.Energy balance of the photovoltaic system.
- 4.Components of the photovoltaic system.
- 5.Sizing of the photovoltaic system.
- 6.Sizing of the electrical installation.
- 7.Steady-state operation of the electrical installation.

Specific objectives:

The student must be able to:

- Understand the behavior of the components of a photovoltaic system.
- Carry out a project for an electrical system with photovoltaic energy.

Related activities:

Projects, midterm exam and final exam.

Full-or-part-time: 62h

Theory classes: 14h

Laboratory classes: 8h

Self study : 40h



ACTIVITIES

PROJECTS

Description:

The projects are carried out in the classroom and outside it, individually or in groups.

Specific objectives:

1. Understand and apply the concepts developed in the theory sessions.
2. Know how to develop an electrical project.
3. Know how to interpret the results obtained.
4. Promote teamwork, task planning, safety and responsibility at work.

Material:

Notes and slides on the ATENEA platform.
General bibliography of the course.

Delivery:

The projects will be submitted in digital format. The assessment of this activity accounts for 50% of the total course mark.

Full-or-part-time: 70h

Theory classes: 15h

Laboratory classes: 15h

Self study: 40h

MIDTERM EXAM

Description:

Individual classroom exam consisting of written exercises.

Specific objectives:

The exam must demonstrate that the student has acquired the basic concepts.

Material:

Midterm exam statement and calculator.

Delivery:

Exam resolution.

It represents 25% of the final course mark.

Full-or-part-time: 28h

Theory classes: 8h

Self study: 20h



FINAL EXAM

Description:

Individual classroom exam consisting of written exercises.

Specific objectives:

The exam must demonstrate that the student has acquired the basic concepts.

Material:

Final exam statement and calculator.

Delivery:

Exam resolution.

It represents 25% of the final course mark.

Full-or-part-time: 27h

Theory classes: 7h

Self study: 20h

GRADING SYSTEM

The assessment of the course will be the weighted sum of the following assessment activities, with the weight indicated for each of them:

First: Projects, with a weight of 50%.

Second: Midterm exam, with a weight of 25%.

Third: Final exam, with a weight of 25%.

For students who meet the requirements and sit the reassessment exam, the mark obtained in the reassessment exam will replace the marks of all assessment activities consisting of face-to-face written tests —continuous assessment tests, midterm exams and final exams—, while the marks for practical activities, assignments, projects and presentations obtained during the course will be maintained.

If the final mark after reassessment is lower than 5.0, it will replace the original mark only if it is higher. If the final mark after reassessment is greater than or equal to 5.0, the final mark for the course will be pass, 5.0.

EXAMINATION RULES.

The projects will be carried out individually or in groups and submitted in written form.

The midterm and final exams will be carried out individually and in written form.

BIBLIOGRAPHY

Basic:

- Rodríguez Amenedo, J. L; Burgos Díaz, J. C; Arnalte Gómez, S. Sistemas eólicos de producción de energía eléctrica. Alcorcón: Rueda, DL 2003. ISBN 9788472071391.

- Villarrubia López, Miguel. Energía eólica. Barcelona: CEAC, cop. 2004. ISBN 9788432910623.

- Villarrubia López, Miguel. Ingeniería de la energía eólica. Barcelona: Marcombo, 2012. ISBN 9788426715807.

- Zabalza Bribián, I. [et al.]. El ahorro energético en el nuevo código técnico de la edificación. Madrid: Fundación Confemetal, DL 2007. ISBN 9788496743304.

- Tobajas Vázquez, M. Carlos. Energía solar fotovoltaica. 2ª ed. Barcelona: Ceysa, 2005. ISBN 8486108624.

- Martínez Jiménez, Amador; Toledano, José Carlos. Dimensionado de instalaciones solares fotovoltaicas. Madrid: Paraninfo, cop. 2012. ISBN 8428332983.

- Castañer Muñoz, Luis; Silvestre Berges, Santiago. Modelling photovoltaic systems: using PSpice [on line]. Chichester: John Wiley & Sons, cop. 2002 [Consultation: 28/05/2024]. Available on: <https://onlinelibrary-wiley-com.recursos.biblioteca.upc.edu/doi/book/10.1002/0470855541>. ISBN 9780470845271.