Course guide
820327 - COEE - Static Converters

Last modified: 04/06/2026

Unit in charge: Barcelona East School of Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering.

Degree: BACHELOR'S DEGREE IN ENERGY ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2026 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish, English

LECTURER

Coordinating lecturer: HERMINIO MARTINEZ GARCIA

Others:

Primer quadrimestre:
ROBERT CALATAYUD CAMPS - Grup: M11, Grup: M12, Grup: M13, Grup: M14
HERMINIO MARTINEZ GARCIA - Grup: M11, Grup: M12, Grup: M13, Grup: M14

Segon quadrimestre:
ROBERT CALATAYUD CAMPS - Grup: T11, Grup: T12, Grup: T13
HERMINIO MARTINEZ GARCIA - Grup: T11, Grup: T12, Grup: T13

PRIOR SKILLS

The skills acquired in the following courses of the Bachelor's Degree in Energy Engineering:

- Electronics Systems (STI - 820017) .
- Electrical Systems (STE - 820016).
- Renewable Energies (ENRE - 295302).

REQUIREMENTS

SISTEMES ELECTRÒNICS - Prerrequisit
ENERGIES RENOVABLES - Prerrequisit

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CEENE-310. Analyse and design electrical energy conversion systems based on static power converters.

Transversal:
5. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

TEACHING METHODOLOGY

Two theory classes per week with a total of 3.0 h/week, which encompass matter of theory and problems, and 1 h/set. of laboratory classes, grouped into fortnightly sessions.

Additionally, throughout the semester, different classes will be held (schedule will be announced at the beginning of term) with the whole group or part thereof in order to explain, develop and assess cross (generic) competences assigned to the subject.

The course uses:

- Lecture methodology by 40%.
- Individual work by 30% .
- Work in groups by 30 %.

The student will develop, in groups of, at most, 3 students, a project of the course design, sizing and / or simulation related to the content of the course.

LEARNING OBJECTIVES OF THE SUBJECT

1.- To know characteristics, advantages and disadvantages of power conversion.
2.- To know the different types, components, configurations, etc. of power converters.
3.- To know the different types of power electronic converters for processing electric energy (AC/DC, DC/DC, DC/AC and AC/AC) for renewable energy systems.
4.- To design and implement conversion static structures for processing electric power in renewable energy systems.
5.- To know the design and implementation of control structures for power static converters.
6.- To know the simulation process of power conversion static structures for electrical energy in renewable systems.

STUDY LOAD

Type	Hours	Percentage
Hours large group	45,0	30.00
Hours small group	15,0	10.00
Self study	90,0	60.00

Total learning time: 150 h

CONTENTS

1.- Introduction to Power Electronics within the Context of Renewable Energies.

Description:
Please, see the Spanish or Catalan version of the contents in order to see the detailed course syllabus.

Specific objectives:
Please, see the Spanish or Catalan version of the contents in order to see the detailed course syllabus.

Related competencies :
07 AAT N3. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

Full-or-part-time: 12h
Theory classes: 2h
Self study : 10h

2.- AC-DC Conversion within the Context of Renewable Energies.

Description:
Please, see the Spanish or Catalan version of the contents in order to see the detailed course syllabus.

Specific objectives:
Please, see the Spanish or Catalan version of the contents in order to see the detailed course syllabus.

Related competencies :
07 AAT N3. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

Full-or-part-time: 24h
Theory classes: 9h
Laboratory classes: 2h
Self study : 13h

3.- DC-DC Conversion within the Context of Renewable Energies.

Description:
Please, see the Spanish or Catalan version of the contents in order to see the detailed course syllabus.

Specific objectives:
Please, see the Spanish or Catalan version of the contents in order to see the detailed course syllabus.

Related competencies :
07 AAT N3. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

Full-or-part-time: 24h
Theory classes: 9h
Laboratory classes: 2h
Self study : 13h

4.- DC-AC Conversion within the Context of Renewable Energies.

Description:
Please, see the Spanish or Catalan version of the contents in order to see the detailed course syllabus.

Specific objectives:
Please, see the Spanish or Catalan version of the contents in order to see the detailed course syllabus.

Related competencies :
07 AAT N3. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

Full-or-part-time: 23h
Theory classes: 8h
Laboratory classes: 2h
Self study : 13h

5.- AC-AC Conversion within the Context of Renewable Energies.

Description:
Please, see the Spanish or Catalan version of the contents in order to see the detailed course syllabus.

Specific objectives:
Please, see the Spanish or Catalan version of the contents in order to see the detailed course syllabus.

Related competencies :
07 AAT N3. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

Full-or-part-time: 23h
Theory classes: 8h
Laboratory classes: 2h
Self study : 13h

6.- Integration of Electrical Energy Conversion Subsystems into Renewable Energy Systems.

Description:
Please, see the Spanish or Catalan version of the contents in order to see the detailed course syllabus.

Specific objectives:
Please, see the Spanish or Catalan version of the contents in order to see the detailed course syllabus.

Related competencies :
07 AAT N3. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

Full-or-part-time: 23h
Theory classes: 6h
Laboratory classes: 2h
Self study : 15h

7.- Power Supply Systems, Voltage Regulators and References.

Description:
Please, see the Spanish or Catalan version of the contents in order to see the detailed course syllabus.

Specific objectives:
Please, see the Spanish or Catalan version of the contents in order to see the detailed course syllabus.

Related competencies :
07 AAT N3. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

Full-or-part-time: 21h
Theory classes: 6h
Laboratory classes: 2h
Self study : 13h

GRADING SYSTEM

Any academic fraud, plagiarism or use or possession of unauthorised means in an assessment activity leads to a mark of zero (0) for the affected test or assignment. Furthermore, in accordance with the University's regulations, if disciplinary proceedings are initiated the subject is recorded as "Pending Assessment" until a decision is reached. These incidents are managed in accordance with the **Action Framework for Academic Integrity in Assessment at the UPC**.

The grade or scoring of the course will be carried out according to:

• Midterm exam: 30 %.
• Final exam: 30 %.
• Course project (project to design, simulate, and implement physically electronic systems for electric energy conversion): 20 %.
- Laboratory activities and tests: 20 %.

All these tasks will also serve to assess the cross (generic) competences assigned to the course.

This course does not have re-assessment test ("prova de reavaluació").

EXAMINATION RULES.

The implementation of the different tests consists of:

• Midterm exams: written tests, theoretical or sizing problems of solar energy testing, and analysis and/or synthesis (design) of electronic systems for electric energy static conversion.
• Final exam: written, theoretical and/or sizing problems of solar energy test, and analysis and synthesis (design) of electronic systems for electric energy static conversion.
• Course project: The course project will involve conducting course design work, simulation and/or physical implementation related to the contents of the subject.
• Activities, testing and laboratory experiments: Laboratory experiences and activities on Static Conversion for Electric Energy.

Thanks to all these tasks, the cross (generic) competences assigned to the course will be also evaluated.

BIBLIOGRAPHY

Basic:
- Ballester Portillo, Eduard; Piqué, Robert. Electrónica de potencia : principios fundamentales y estructuras básicas. Barcelona: Marcombo, 2011. ISBN 9788426716699.
- Hart, Daniel W. Electrónica de Potencia. Madrid [etc.]: Prentice Hall, cop. 2001. ISBN 8420531790.
- Pozo Ruz, Ana. Convertidores conmutados de potencia : test de autoevaluación. Barcelona: Marcombo Universitaria, 2017. ISBN 9788426724830.

Complementary:
- Erickson, Robert W.; Maksimovic, Dragan. Fundamentals of power electronics [on line]. 2nd ed. Dordrecht: Kluwer Academic Publishers, cop. 2001 [Consultation: 24/04/2020]. Available on: https://link.springer.com/book/10.1007/b100747. ISBN 0792372700.
- Mohan, Ned; Undeland, Tore M.; Robbins, William P. Power electronics : converters, applications, and design. 3rd ed. New York [etc.]: John Wiley & Sons, cop. 2003. ISBN 0471429082.
- Barrado Bautista, Andrés; Lázaro Blanco, Antonio. Problemas de electrónica de potencia. Madrid [etc.]: Prentice Hall, cop. 2007. ISBN 9788420546520.
- Mohan, Ned. Power electronics : a first course. Hoboken: John Wiley & Sons, cop. 2012. ISBN 9781118074800.

RESOURCES

Computer material:
- Moodle ATENEA: http://atenea.upc.edu/moodle/

Other resources:
Please, see the Spanish or Catalan version of the contents in order to see the detailed course syllabus.