



# Course guide

## 295302 - ENRE - Renewable Energies

**Last modified:** 14/06/2023

**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:** 2023    **ECTS Credits:** 6.0    **Languages:** Catalan, Spanish, English

### LECTURER

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**Coordinating lecturer:** HERMINIO MARTINEZ GARCIA

**Others:**

Primer quadrimestre:

ROBERT CALATAYUD CAMPS - Grup: T11, Grup: T12

ROQUE LÓPEZ PARICIO - Grup: T11, Grup: T12, Grup: T13, Grup: T14

Segon quadrimestre:

ROBERT CALATAYUD CAMPS - Grup: M11, Grup: M12

PILAR FRANCISCA LUIS PEÑA - Grup: M11, Grup: M12, Grup: M13, Grup: M14, Grup: M15

### PRIOR SKILLS

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

- Electronics Systems (STI - 820017) .
- Energy Static Converters (COEE - 820327).
- Energy Resources (RE-EN - 820329).

### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

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**Specific:**

CEENE-210. Measure and design energy production systems based on renewable energies.

**Transversal:**

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.

## TEACHING METHODOLOGY

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Two classes per week with a total of 3.0 hours, which encompass matter of theory, problems and laboratory classes.

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

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- 1.- To know characteristics, advantages and disadvantages of the solar energy applications and facilities.
- 2.- To know the different types, components, configurations, etc.. of solar thermal systems (STS).
- 3.- To design and size solar thermal systems for different applications (sanitary hot water -SHW-, heating, water heating for swimming pools, etc.).
- 4.- To know the different types, components, settings, etc.. of photovoltaic solar energy systems (PV systems).
- 5.- To design and size solar PV systems for different applications (electricity for isolated facilities, systems connected to the grid, water pumping, etc.).
- 6.- 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.
- 7.- To design and implement conversion static structures for processing electric power in renewable energy systems.
- 8.- To know the design and implementation of control structures for power static converters.
- 9.- To know the simulation process of power conversion static structures for electrical energy in renewable systems.

## STUDY LOAD

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

**Total learning time:** 150 h



## CONTENTS

### 1.- Static Structures for the Conversion and Processing of Electrical Energy in Renewable Energy Facilities.

**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:** 18h

Theory classes: 6h

Self study : 12h

### 2.- Introduction to Solar Energy. Passive Solar Energy and Solar or Bioclimatic Architecture.

**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:** 6h

Theory classes: 2h

Self study : 4h

### 3.- Thermal Solar 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:** 19h

Theory classes: 8h

Self study : 11h



#### 4.- Integration of Thermal Solar 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: 12h

Self study : 11h

#### 5.- Photovoltaic Solar 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:** 21h

Theory classes: 8h

Self study : 13h

#### 6.- Wind Energy (WE) 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:** 21h

Theory classes: 13h

Self study : 8h



### 7.- Integration of Photovoltaic Solar 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:** 21h

Theory classes: 8h

Self study : 13h

### 8.- Examples of Sizing for Solar, Wind and Hybrid Energy Facilities.

**Description:**

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: 8h

Self study : 13h

## GRADING SYSTEM

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

- 1 or 2 midterm exams: 30%.
- Final Exam: 30%.
- Course project (project to design solar systems and facilities, or analyze, design and implement electronic systems for electric energy conversion, in order to assess cross (generic) competences assigned to the course): 20%.
- Optional 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 revaluació").

## EXAMINATION RULES.

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The implementation of the different written 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, sizing and/or simulation related to the contents of the subject.
- Activities, testing and optional laboratory experiments: Laboratory experiences and activities on Solar Energy and Static Conversion for Electric Energy.

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

## BIBLIOGRAPHY

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### Basic:

- CENSOLAR. Instalaciones de energía solar. Sevilla: PROGENSEA, 1997-2001. ISBN 8486505380.
- Barrado Bautista, Andrés; Lázaro Blanco, Antonio. Problemas de electrónica de potencia. Madrid [etc.]: Prentice Hall, cop. 2007. ISBN 9788420546520.
- Curso de experto profesional en energía fotovoltaica. Sevilla: PROGENSEA, 2009. ISBN 9788495693495.
- Hart, Daniel W. Electrónica de potencia. Madrid [etc.]: Prentice Hall, cop. 2001. ISBN 8420531790.
- Pareja Aparicio, Miguel. Energía solar fotovoltaica : cálculo de una instalación aislada. 2ª ed. Barcelona: Marcombo, 2010. ISBN 9788426715968.
- Alonso Abella, Miguel. Sistemas fotovoltaicos: introducción al diseño y dimensionado de instalaciones de energía solar fotovoltaicas. 2ª ed. Madrid: Publicaciones Técnicas, 2005. ISBN 8486913128.

### Complementary:

- Energía solar fotovoltaica : manual del proyectista. [Valladolid]: Ente Regional de la Energía de Castilla y León (EREN), DL 2004. ISBN 849718257X.

## RESOURCES

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### Computer material:

- Moodle ATENEA: <http://atenea.upc.edu/moodle/>. <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.