

## 340223 - SIFE-E7P09 - Solar and Wind Power Systems

Coordinating unit:	340 - EPSEVG - Vilanova i la Geltrú School of Engineering
Teaching unit:	709 - EE - Department of Electrical Engineering
Academic year:	2018
Degree:	BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional) BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Teaching unit Optional) BACHELOR'S DEGREE IN INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING (Syllabus 2009). (Teaching unit Optional) BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)
ECTS credits:	6
Teaching languages:	Catalan

### Teaching staff

Coordinator:	Eusebi Martinez Piera
Others:	Eusebi Martinez Piera

### Degree competences to which the subject contributes

#### Specific:

1. CE28. Applied knowledge of renewable energies.

### Teaching methodology

- In the theory classes, will be exposed and develop the theoretical foundations of programmed materials. They consist of theoretical explanations complemented by activities to encourage participation, discussion and critical analysis by students.
- In the classes of problems will arise and solve exercises related to the matters. Students should meet individually or in groups, indicating problems.
- Within hours, students will conduct laboratory practices as required and submit the relevant report of the activity along with appropriate calculations and critical considerations.
- Will work in groups during the course of a specific topic related to the subject.

### Learning objectives of the subject

- Study in depth the power generation systems with solar and wind energy.
- Size the PV and eolic systems.
- Introduce distributed generation.



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### Study load

Total learning time: 150h	Hours large group:	45h	30.00%
	Hours medium group:	0h	0.00%
	Hours small group:	15h	10.00%
	Guided activities:	0h	0.00%
	Self study:	90h	60.00%

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### Content

<p>1.- General concepts.</p>	<p>Learning time: 14h Theory classes: 4h Laboratory classes: 2h Self study : 8h</p>
<p>Description: 1.1.- Features of renewable energy. Energy market and regulatory framework. 1.2.- Plans to support renewable energy. Social and economic aspects. 1.3.- Isolated systems connected to the network. 1.4.- Power quality. Integration in the grid.</p>	
<p>2.- Photovoltaic systems.</p>	<p>Learning time: 51h Theory classes: 10h Laboratory classes: 5h Self study : 36h</p>
<p>Description: 2.1.- Solar Radiation. Model for determining the incident solar radiation. 2.2.- Photovoltaic effect. Types of photovoltaic cells. Technological aspects. 2.3.- Investors. Key Features. Configurations. Integration with the grid. Monitoring and control. 2.4.- Design of photovoltaic power in parallel with the network. Profitability analysis. 2.5.- Legal and environmental aspects. 2.6.- Accumulators. Types and main characteristics. 2.7.- Protection of photovoltaic systems. 2.8.- Design of PV isolated network. Profitability analysis.</p>	
<p>3.- Wind systems.</p>	<p>Learning time: 54h Theory classes: 12h Laboratory classes: 6h Self study : 36h</p>
<p>Description: 3.1.- The wind. Variability of wind speed. Frequency distribution. Determination of the wind potential of a geographic location. 3.2.- Fundamentals of aerodynamics. Types of wind turbines. 3.3.- Constituent parts of a wind turbine. Orientation. Power regulation. 3.4.- Wind farm: Civil works, electrical installation and protection systems. 3.5.- Integration with the grid. Monitoring and control. 3.6.- Dimensioning of a wind farm. Profitability analysis. 3.7.- Legal and environmental aspects. Evolution of installed capacity.</p>	

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<p>4.- Distributed generation.</p>	<p>Learning time: 31h Theory classes: 4h Laboratory classes: 2h Self study : 25h</p>
<p>Description: 4.1.- Introduction to distributed generation. Technologies. Interconnect systems. 4.2.- Impact of DG on the grid. Interaction between generators. And harmonic interaction between charges. 4.3.- Factors to consider for the development of DG. Environmental and regulatory framework.</p>	

### Qualification system

- Test done during the course (30%)
- Test done at the end (40%)
- Realization of problems, and work practices, group or individual (30%)

### Regulations for carrying out activities

- The written tests are face and individual.
- In the classes of problems and / or laboratory practices will be assessed, where appropriate, the prior work with the presentation of results of each activity.

### Bibliography

#### Basic:

- Burton, Tony [et al.]. Wind energy handbook [on line]. 2nd ed. Chichester: John Wiley & Sons, 2011 [Consultation: 17/09/2014]. Available on: <<http://onlinelibrary.wiley.com/book/10.1002/9781119992714>>. ISBN 9781119992714.
- Teodorescu, Remus. Grid converters for photovoltaic and wind power systems [on line]. Chichester: John Wiley & Sons, 2011 [Consultation: 17/09/2014]. Available on: <<http://onlinelibrary.wiley.com/book/10.1002/9780470667057>>. ISBN 9780470667057.
- Hau, Erich. Wind turbines: fundamentals, technologies, application and economics [on line]. 2nd ed. Berlin: Springer, 2006 [Consultation: 03/11/2018]. Available on: <<http://dx.doi.org/10.1007/978-3-642-27151-9>>. ISBN 9783540242406.
- Heier, Seiger. Grid integration of wind energy conversion systems. 2nd ed. Chichester [etc.]: John Wiley & Sons, 2006. ISBN 0470868996.
- Stiebler, Manfred. Wind energy systems for electric power generation [on line]. Berlin: Springer, 2008 [Consultation: 03/11/2018]. Available on: <<http://dx.doi.org/10.1007/978-3-540-68765-8>>. ISBN 9783540687627.