



1. General information

Course: RENEWABLE ENERGY TECHNOLOGIES

Type: CORE COURSE

Degree: 413 - UNDERGRADUATE DEGREE PROGRAMME IN ELECTRICAL ENGINEERING

Center: 605 - SCHOOL OF INDUSTRIAL ENGINEERS. AB

Year: 3

Main language: Spanish

Use of additional languages:

Web site:

Code: 56414

ECTS credits: 6

Academic year: 2022-23

Group(s): 10

Duration: First semester

Second language: English

English Friendly: Y

Bilingual: N

Lecturer: EMILIO GOMEZ LAZARO - Group(s): 10

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Lecturer: FRANCISCO JAVIER LÓPEZ FLORES - Group(s): 10

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2. Pre-Requisites

Not established

3. Justification in the curriculum, relation to other subjects and to the profession

Not established

4. Degree competences achieved in this course

Course competences

Code	Description
CB01	Prove that they have acquired and understood knowledge in a subject area that derives from general secondary education and is appropriate to a level based on advanced course books, and includes updated and cutting-edge aspects of their field of knowledge.
CB02	Apply their knowledge to their job or vocation in a professional manner and show that they have the competences to construct and justify arguments and solve problems within their subject area.
CB03	Be able to gather and process relevant information (usually within their subject area) to give opinions, including reflections on relevant social, scientific or ethical issues.
CB04	Transmit information, ideas, problems and solutions for both specialist and non-specialist audiences.
CB05	Have developed the necessary learning abilities to carry on studying autonomously
CEE10	Applied knowledge of renewable energies.
CG03	Knowledge of basic and technological subjects to facilitate learning of new methods and theories, and provide versatility to adapt to new situations.
CG04	Ability to solve problems with initiative, decision-making, creativity, critical reasoning and to communicate and transmit knowledge, skills and abilities in the field of industrial engineering.
CG06	Ability to handle specifications, regulations and mandatory standards.
CG07	Ability to analyse and assess the social and environmental impact of technical solutions.
CT01	Knowledge of a second language.
CT02	Knowledge and application of information and communication technology.
CT03	Ability to communicate correctly in both spoken and written form.
CT04	Knowledge of ethical commitment and professional ethics.

5. Objectives or Learning Outcomes

Course learning outcomes

Description

Knowledge of the energy framework for renewable energies.

Ability to handle specifications, regulations and typical mandatory standards. Regulations.

Applied knowledge of the different renewable energy technologies.

6. Units / Contents

Unit 1: Introduction

Unit 2: Wind power

Unit 3: Solar and geothermal energy

Unit 4: Biomass

Unit 5: Other energy sources and storage

7. Activities, Units/Modules and Methodology

Training Activity	Methodology	Related Competences (only degrees before RD 822/2021)	ECTS	Hours	As	Com	Description
Class Attendance (theory) [ON-SITE]	Lectures	CB01 CB02 CB03 CB04 CB05 CEE10 CG03 CG04 CG06 CG07 CT01 CT02 CT03 CT04	1.2	30	Y	N	
Problem solving and/or case studies [ON-SITE]	Problem solving and exercises	CB01 CB02 CB03 CB04 CB05 CEE10 CG03 CG04 CG06 CG07 CT01 CT02 CT03 CT04	0.4	10	Y	N	
Laboratory practice or sessions [ON-SITE]	Practical or hands-on activities	CB01 CB02 CB03 CB04 CB05 CEE10 CG03 CG04 CG06 CG07 CT01 CT02 CT03 CT04	0.6	15	Y	Y	
Writing of reports or projects [OFF-SITE]	Practical or hands-on activities	CB01 CB02 CB03 CB04 CB05 CEE10 CG03 CG04 CG06 CG07 CT01 CT02 CT03 CT04	3.6	90	Y	N	
Final test [ON-SITE]	Assessment tests	CB01 CB02 CB03 CB04 CB05 CEE10 CG03 CG04 CG06 CG07 CT01 CT02 CT03 CT04	0.2	5	Y	Y	
Total:			6	150			
Total credits of in-class work: 2.4			Total class time hours: 60				
Total credits of out of class work: 3.6			Total hours of out of class work: 90				

As: Assessable training activity

Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

8. Evaluation criteria and Grading System

Evaluation System	Continuous assessment	Non-continuous evaluation*	Description
Practicum and practical activities reports assessment	5.00%	5.00%	
Progress Tests	35.00%	35.00%	
Final test	60.00%	60.00%	
Total:	100.00%	100.00%	

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject, an ordinary and an extraordinary one (evaluating 100% of the competences).

9. Assignments, course calendar and important dates

Not related to the syllabus/contents	
Hours	hours
Final test [PRESENCIAL][Assessment tests]	5
Unit 1 (de 5): Introduction	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	4
Unit 2 (de 5): Wind power	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	18
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	8
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	8
Writing of reports or projects [AUTÓNOMA][Practical or hands-on activities]	65
Unit 3 (de 5): Solar and geothermal energy	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	3
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	5
Writing of reports or projects [AUTÓNOMA][Practical or hands-on activities]	20
Unit 4 (de 5): Biomass	
Activities	Hours

Class Attendance (theory) [PRESENCIAL][Lectures]	3
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	2
Writing of reports or projects [AUTÓNOMA][Practical or hands-on activities]	5
Unit 5 (de 5): Other energy sources and storage	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Global activity	
Activities	hours
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	15
Writing of reports or projects [AUTÓNOMA][Practical or hands-on activities]	90
Final test [PRESENCIAL][Assessment tests]	5
Class Attendance (theory) [PRESENCIAL][Lectures]	30
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	10
Total horas: 150	

10. Bibliography and Sources						
Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Jaquelin Cochran, Mackay Miller, Michael Milligan, Erik Ela, Douglas Arent, Aaron Bloom, Matthew Futch, Juha Kiviluoma, Hannele Holttinen, Antje Orths, Emilio Gómez-Lázaro, Sergio Martín-Martínez, Steven Kukoda, Glycon Garcia, Kim Møller Mikkelsen, Zhao Yongqiang, y Kaare Sandholt	Market evolution: Wholesale electricity market design for 21 st century power systems	21stCenturyPower.org	EEUU		2013	
T. Burton	http://www.nrel.gov/docs/fy14osti/57477.pdf Wind energy handbook	John Wiley&Sons		0-471-48997-2	2001	
J. M. Adell, J. Canales, M. Gálvez, A. Frossard, J. L. Garda, E. Gómez-Lázaro, N. Goodall, E. Méndez, J. L. Plá, A. Pototschnig, J. C. Ruiz, A. Salem, R. Schaeffer, y J. Verde	Energía: Desarrollos tecnológicos en la protección medioambiental	Thomson Reuters		978-84-470-3806-0	2011	
A. Molina-García and A.D. Hansen and E. Muljadi and V. Gevorgian and J. Fortmann and E. Gómez-Lázaro	Large Scale Grid Integration of Renewable Energy Sources	The Institution of Engineering and Technology		978-1-78561-162-9	2017	
A. Honrubia-Escribano; E. Gómez-Lázaro; J. Fortmann; P. Sørensen; S. Martin-Martinez	http://dx.doi.org/10.1049/PBPO0980 Generic dynamic wind turbine models for power system stability analysis: A comprehensive review	Elsevier			2018	
Andrzej M. Trzynadlowski (Editor), Eduard Muljadi, Emilio Gomez-Lazaro, Antonio Ginart	https://www.sciencedirect.com/science/article/pii/S1364032117309401 Power Electronic Converters and Systems: Frontiers and Applications	The Institution of Engineering and Technology		978-1849198264	2015	
E. Muljadi and E. Gómez-Lázaro and A. Ginart	https://iet.presswarehouse.com/books/BookDetail.aspx?productID=405109 Power Electronic Converters and Systems: Frontiers and Applications	The Institution of Engineering and Technology		978-1-84919-826-4	2015	
Sorensen, Bent	http://dx.doi.org/10.1049/PBPO074E Renewable energy : its physics, engineering, use, environmen	Academic Press		0-12-656153-2	2004	
Emilio Gómez Lázaro	Material desarrollado para la asignatura					El diverso material que el profesor considera importante para el seguimiento de la asignatura (copias de las diapositivas utilizadas en clase para los diferentes temas, guiones de prácticas, enlaces de interés) estarán disponibles para su descarga a través de Campus Virtual, Moodle
	Sitio moodle de la asignatura					
H. Holttinen, J. Kiviluoma, A. Robitaille, N. A. Cutululis, A. Orths, F. Van Hulle, I. Pineda, B. Lange, M. O'Malley, J. Dillon, E. M. Carlini, C. Vergine, J. Kondoh, Y. Yasuda, M. Gibescu, J. Olav	Design and operation of power systems with large amounts of wind power	Julkaisija-Utgivare	Helsinki, Finland	978-951-38-7308-0	2013	

Tande, A. Estanqueiro, E. Gómez-Lázaro, L. Söder, J. C. Smith, M. Milligan, y D. Lew.	http://www.ieawind.org/task_25.html				
J. L. Rodríguez Amenedo y otros	Sistemas eólicos de producción de energía eléctrica	Editorial Rueda	84-7202-139-1	2003	
S. Martin-Martínez, A. Viguera-Rodríguez, E. Gómez-Lázaro, A. Molina-García, E. Muljadi, y M. Milligan	Advances in wind power	Intech	Rijeka, Croatia 978-953-51-0863-4	2012	
	http://www.intechopen.com/books/advances-in-wind-power				
A. Orths, H. Abildgaard, F. van Hulle, J. Kiviluoma, B. Lange, M. O'Malley, D. Flynn, A. Keane, J. Dillon, E. M. Carlini, J. O. Tande, A. Estanqueiro, E. Gómez-Lázaro, L. Söder, M. Milligan, J. C. Smith, y C. Clark.	16. WIND INTEGRATION STUDIES	Helsinki, Finland	Helsinki, Finland 978-951-38-7308-0	2013	
	http://www.ieawind.org/task_25.html				