UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course: ENERGY CERTIFICATION AND RENEWABLE ENERGIES
Code: 59339
Type: ELECTIVE
ECTS credits: 4.5
Degree: 315 - UNDERGRADUATE DEGREE IN BUILDING ENGINEERING
Academic year: 2023-24
Center: 308 - SCHOOL POLYTECHNIC OF CUENCA
Group(s): 30
Year: 4
Duration: C2
Main language: Spanish
Second language:
Use of additional languages:
English Friendly: Y
Web site:
Bilingual: N

Lecturer: **JOAQUIN FUENTES DEL BURGO** - Group(s): **30**

Building/Office	Department	Phone number	Email	Office hours
Escuela Politécnica. Despacho 2.03	INGENIERÍA CIVIL Y DE LA EDIFICACIÓN	4838	joaquin.fuentes@uclm.es	The offices hours will be published on the Virtual Campus and on the office door 2.03. They can also be consulted in the "Secretaria Virtual".

Lecturer: **VICTOR JOSE PEREZ ANDREU** - Group(s): **30**

Building/Office	Department	Phone number	Email	Office hours
Escuela Politécnica de Cuenca/Despacho 1.11	INGENIERÍA CIVIL Y DE LA EDIFICACIÓN	4810	victor.perez@uclm.es	They can be consulted in the "Secretaria Virtual".

2. Pre-Requisites

It is recommended that the student enrolls in the subject that has passed the following subjects:

Mathematics Fundamentals I

Mathematics Fundamentals II

Physics Fundamentals I

Physics Fundamentals II

Architectural Drawing I

Construction Materials

Construction I

Construction II

Construction III

Building Facilities I

Building Facilities II

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

The Technical Building Code includes the provision of renewable energy installations in the building. Thus, sanitary hot water production (DHW) installations with solar thermal energy are mandatory in all types of buildings that have DHW consumption and, depending on the size and use of the building, the production of electrical energy with photovoltaic solar installations.

On the other hand, as of the approval of the RD 47/2007 and the subsequent modification and update with the RD 235/2013, the basic procedures have been established for the certification of the energy efficiency of new buildings as well as of existing buildings . With the last royal decree, it is mandatory to carry out the certification of the energy efficiency of buildings at the project, finished building and existing buildings.

This normative reality comes from European directives which include the need to reduce the energy consumption of buildings, in order to reduce the environmental impact of their use, as well as to minimize the economic cost in certain types of services (heating, sanitary hot water, etc.).

With this background, this subject aims to cover these new challenges that society imposes on the Building Engineer in terms of knowledge of renewable energy and certification of the energy efficiency of buildings.

4. Degree competences achieved in this course

Course competences

Code	Description
E42	Knowledge of complementary subjects, both technological and humanistic, oriented to a certain specialization of open, multidisciplinary nature and with direct application in the professional field of a Building Engineer, open and sensitive to changes and new professional challenges that may arise.
G01	Ability for analysis and synthesis
G03	Ability to manage information
G05	Decision making
G06	Critical thinking
G07	Teamwork
G12	Autonomous learning
G18	Initiative and entrepreneurial spirit
G21	Command of Information and Communication Technologies (ICT)
G22	Correct oral and written communication

5. Objectives or Learning Outcomes

Course learning outcomes

Description

Experience human and professional relationships in the business and institutional environment.

Evaluation of the socio-environmental impact of the building to become aware of working in an integrated field, being sensitive to the possibility to participate in multidisciplinary initiatives with application of their specific professional capacity.

Acquisition of practical skills directly in companies or institutions.

Acquire knowledge and skill in the use of computer tools that give the student a greater operational capacity of the knowledge acquired. Possibility of autonomously expanding these advances through the search for new applications or with the development of those already acquired.

Complement the basic and specific training oriented to a certain specialization of open, multidisciplinary nature and with direct application in the professional field.

Additional outcomes

- Know and identify the systems that make up the solar thermal and photovoltaic installations. - Understand the physical phenomena that govern the operation of the facilities. - Know the different components and basic elements that constitute the facilities as well as their intrinsic functioning. - Know the materials used in the realization of solar thermal and photovoltaic installations, studying their characteristics and the properties related to the application that is being given. - Know the systems of execution of the facilities, as well as their control and the maintenance tasks of the same. - Know and use the standards that govern the design, calculation, execution and control of the facilities. - Apply calculation methods in the sizing and evaluation of solar thermal and photovoltaic facilities. - Know and apply the simplified and general procedures for the realization of the energy certification of buildings. - Use measuring devices applied to the control and verification of the operation of the facilities, as well as handle tools. - Develop the ability to observe and analyze facilities in the assembly phase or already executed, to increase the practical continuous training and the critical sense necessary for professional development.

Know the fundamental aspects of isolated small wind turbine for electrical energy installations.

Know the fundamental aspects of geothermal energy installations.

Know the regulations regarding the energy certification of buildings. Apply general and simplified procedures for the realization of energy certification of new and existing buildings.

6. Units / Contents

Unit 1: Energy certification of buildings

- **Unit 1.1** Energy certification of existing buildings
- **Unit 1.2** Energy certification of new buildings
- **Unit 1.3** Environmental management of buildings in BIM context
- **Unit 1.4**

Unit 2: Solar thermal facilities.

- **Unit 2.1** Solar thermal facilities. Generalities and schemes.
- **Unit 2.2** Radiation and shadows.
- **Unit 2.3** Collector subsystem.
- **Unit 2.4** Hydraulic subsystem.
- **Unit 2.5** Exchange and accumulation subsystem.
- **Unit 2.6** Control and regulation subsystem.
- **Unit 2.7** Sizing.

Unit 3: Isolate photovoltaics system.

- **Unit 3.1** Components of photovoltaic solar energy installations.
- **Unit 3.2** Sizing of isolate photovoltaic solar energy installations.

Unit 4: Heatpump and Geothermal installations.

Unit 5: Installations of small wind turbine.

ADDITIONAL COMMENTS, REMARKS

The order in which the subjects are taught, as well as their extension, will depend on the real hours available during the academic course.

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	E42 G01 G05 G06 G21 G22	0.36	9	N	-	
Problem solving and/or case studies [ON-SITE]	Problem solving and exercises	E42 G01 G05 G06 G21	0.54	13.5	N	-	
Computer room practice [ON-SITE]	Practical or hands-on activities	E42 G01 G05 G06 G07 G12 G21 G22	0.68	17	N	-	
Project or Topic Presentations [ON-SITE]	Self-study	G01 G03 G05 G06 G07 G12 G18 G21 G22	0.06	1.5	Y	N	Oral presentation of topics (POT).
Practicum and practical activities report writing or preparation [OFF-SITE]	project-based learning	E42 G01 G03 G05 G06 G07 G12 G21 G22	0.48	12	Y	N	Preparation and delivery of an energy certification for the energy rehabilitation project of an existing building, a new building or another type of configuration (CE); a technical project of a solar thermal installation (PTST) and a technical project of a photovoltaic solar installation (PTSF).
Other off-site activity [OFF-SITE]	Problem solving and exercises	E42 G01 G05 G06 G12	1.14	28.5	Y	N	
Study and Exam Preparation [OFF-SITE]	Self-study		0.76	19	N	-	
Practicum and practical activities report writing or preparation [OFF-SITE]	project-based learning	E42 G01 G03 G05 G06 G07 G12 G18 G21 G22	0.32	8	Y	N	
Final test [ON-SITE]	Assessment tests	E42 G01 G03 G05 G06 G12 G21 G22	0.16	4	Y	N	
		Total:	**4.5**	**112.5**			
		Total credits of in-class work: 1.8					**Total class time hours: 45**
		Total credits of out of class work: 2.7					**Total hours of out of class work: 67.5**

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
Final test	0.00%	100.00%	
			A study of some of the aspects related to solar thermal and photovoltaic systems should be carried out, delivering in class the documentation

Oral presentations assessment	10.00%	0.00%	with the recommended bibliography and make a PowerPoint presentation of 5 to 10 minutes with the most important aspects of the subject.
Practicum and practical activities reports assessment	90.00%	0.00%	The energy certification of a building, home or business place, the project of a solar thermal installation and the project of a photovoltaic solar installation will be carried out. The quality, correctness and adequacy of the solution proposed in the technical documentation requested will be evaluated.
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).

Evaluation criteria for the final exam:

Continuous assessment:

During the development of the subject a score of 0 to 10 points will be obtained in each of the following activities: the Oral Presentation of Themes (POT), the Energy Certification (CE), the Technical Project of a Solar Thermal Installation (PTST) and the Technical Project of a Photovoltaic Solar Installation (PTSF).

The previous grades will be saved for the ordinary and extraordinary calls.
The Final Rating (CF) will be given by the following expression: CF = 0.50 * CE + 0.10 * POT + 0.30 * PTST + 0.10 * PTSF

In case of not obtaining the final grade CF = 5.0 points, the ordinary examination will consist in making a memory of an energy certification of a new, existing or commercial building.

Non-continuous evaluation:

The student, who justifiably cannot attend the training activities regularly, must communicate it to the lecturer of the subject at the beginning of the semester and may carry out the activities and present them in the ordinary or extraordinary exams period, at a time agreed with the professor.

Specifications for the resit/retake exam:

The Final Rating (CF) will be given by the following expression: CF = 0.50 * CE + 0.10 * POT + 0.30 * PTST + 0.10 * PTSF
In case of not obtaining the final grade CF = 5.0 points, the ordinary examination will consist in making a memory of an energy certification of a new, existing or commercial building.

Specifications for the second resit / retake exam:

The examination of the special call for completion will consist of making a technical report of some of the practices delivered during the course (CE, PTST, PTSF).

9. Assignments, course calendar and important dates

Not related to the syllabus/contents

Hours	**hours**

General comments about the planning: The time planning and evaluation activities designed may vary depending on the actual hours available during the semester and the evolution of teaching. The topics will be taught sequentially, although the proposed order may vary.

Unit 1 (de 5): Energy certification of buildings

Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2.25
Computer room practice [PRESENCIAL][Practical or hands-on activities]	17
Project or Topic Presentations [PRESENCIAL][Self-study]	.75
Practicum and practical activities report writing or preparation [AUTÓNOMA][project-based learning]	12
Other off-site activity [AUTÓNOMA][Problem solving and exercises]	5.5
Study and Exam Preparation [AUTÓNOMA][Self-study]	5.5
Final test [PRESENCIAL][Assessment tests]	2

Unit 2 (de 5): Solar thermal facilities.

Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	2.5
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	8
Project or Topic Presentations [PRESENCIAL][Self-study]	.5
Other off-site activity [AUTÓNOMA][Problem solving and exercises]	15
Study and Exam Preparation [AUTÓNOMA][Self-study]	5.4
Practicum and practical activities report writing or preparation [AUTÓNOMA][project-based learning]	5
Final test [PRESENCIAL][Assessment tests]	1

Unit 3 (de 5): Isolate photovoltaics system.

Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	1.75
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	3
Project or Topic Presentations [PRESENCIAL][Self-study]	.25
Other off-site activity [AUTÓNOMA][Problem solving and exercises]	5
Study and Exam Preparation [AUTÓNOMA][Self-study]	3.6
Practicum and practical activities report writing or preparation [AUTÓNOMA][project-based learning]	3
Final test [PRESENCIAL][Assessment tests]	.5

Unit 4 (de 5): Heatpump and Geothermal installations.

Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	1.5
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1.5
Other off-site activity [AUTÓNOMA][Problem solving and exercises]	1
Study and Exam Preparation [AUTÓNOMA][Self-study]	2.7
Final test [PRESENCIAL][Assessment tests]	.5

Unit 5 (de 5): Installations of small wind turbine.

Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Lectures]	1
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	.5
Other off-site activity [AUTÓNOMA][Problem solving and exercises]	2
Study and Exam Preparation [AUTÓNOMA][Self-study]	1.8
Final test [PRESENCIAL][Assessment tests]	.5

Global activity

Activities	**hours**
Final test [PRESENCIAL][Assessment tests]	4.5
Project or Topic Presentations [PRESENCIAL][Self-study]	1.5

Practicum and practical activities report writing or preparation [AUTÓNOMA][project-based learning]	12
Practicum and practical activities report writing or preparation [AUTÓNOMA][project-based learning]	8
Class Attendance (theory) [PRESENCIAL][Lectures]	9
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	13
Computer room practice [PRESENCIAL][Practical or hands-on activities]	17
Other off-site activity [AUTÓNOMA][Problem solving and exercises]	28.5
Study and Exam Preparation [AUTÓNOMA][Self-study]	19
Total horas:	112.5

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
AGUER, MARIO; JUTGLAR, LUIS; MIRANDA, ANGEL L.	El Ahorro Energético: Estudios de Viabilidad Económica.	Librería Díaz de Santos.				Especializada
ALONSO ABELLA, M.	Sistemas fotovoltaicos. introducción al diseño y dimensionado de instalaciones de energía solar fotovoltaica.	Era Solar.				Básica
ASIT	Guia ASIT de la energia solar térmica.	ASIT	MADRID		2010	
ATECYR	DTIE 7.03. Entrada de datos a los programas LIDER y CALENER VyP.	ATECYR				Básica
ATECYR	Fundamentos de energía solar para ACS y climatización. Buenas prácticas	ATECYR	Madrid		2016	
ATECYR	Guia tecnica de agua caliente sanitaria central	IDAE	MADRID		2009	
CENSOLAR	Sistemas solares térmicos	CENSOLAR				Básica
Castro, M.; et al.	Sistemas de bombeo eólicos y fotovoltaicos	PROGENSA			2002	Básica
Ente Regional de la Energia de Castilla y León, D.L	Energia solar térmica : manual del proyectista	Junta de Castilla y León, Consejería de Industria, Comercio y Turismo			2002	Básica
FUENTES, A. ; ÁLVAREZ, M.	Prácticas de energía solar fotovoltaica. Edita:	CENSOLAR				Básica
IDAE	Instalaciones de Energía Solar Térmica. Pliego de Condiciones Técnicas de Instalaciones de Baja Temperatura. Edita:	IDAE				Básica
IDAE	Instalaciones de energía solar fotovoltaica. Pliego de condiciones técnicas de instalaciones aisladas de red.	IDAE				Básica
IDAE	Instalaciones de energía solar fotovoltaica. Pliego de condiciones técnicas de instalaciones conectadas a red.	IDAE.				Básica
J. JUANA; F. SANTOS / A. CRESPO /M.A. HERRENO	Energías Renovables para el Desarrollo	Paraninfo				Especializada
LORENZO, E.; CAAMAÑO-MARTÍN, E.	Cuaderno de campo de electrificación rural fotovoltaica	Progensa				Básica
MARCO MONTORO, J.	Instalaciones solares fototérmicas de baja temperatura. Diseño y aplicaciones	Era Solar				Especializada
Méndez Muñiz, J.M.; Cuervo García, R.	Energía solar fotovoltaica 2ª Ed.	FC Editorial	Madrid		2007	
Méndez Muñiz, J.M.; Cuervo García, R.	Energía solar térmica	FC Editorial	Madrid			
PEREDA SUQUET, P.	Proyecto y cálculo de instalaciones solares térmicas.					Especializada
Pareja Aparicio, M.	Energía solar fotovoltaica. Cálculo de una instalación aislada. 2ª Ed.	Marcombo	Barcelona		2010	
QUILES, P.V.	DTIE 8.04 : energía solar térmica. Casos prácticos	ATECYR			2010	Básica
REY MARTÍNEZ, F.J. ; VELASCO GÓMEZ, E.	Eficiencia energética en edificios. Certificación y auditorías energéticas	Paraninfo				Especializada
IDAE	Guía técnica de procedimientos y aspectos de la simulación de instalaciones térmicas en edificios https://www.idae.es/publicaciones/guia-tecnica-procedimientos-y-aspectos-de-la-simulacion-de-instalaciones-termicas-en				2008	Especializada
ATECYR	Guía técnica Diseño de sistemas de intercambio geotérmico de circuito cerrado http://www.mincotur.gob.es/energia/desarrollo/EficienciaEnergetica/RITE/Reconocidos/Reconocidos/Gu%C3%ADas%20t%C3%A9cnicas/Guia_Climatizacion_Bomba.pdf	IDAE	Madrid		2012	
Gobierno de Castilla-Lan Mancha	Decreto 6/2011, sobre actuaciones en materia de certificación energética de edificios en la Comunidad Autónoma de Castilla-La Mancha y creación del Registro Autonómico de Certificados de Eficiencia Energética de Edificios y Entidades de Verificación de la Conformidad. https://energia.gob.es/desarrollo/EficienciaEnergetica/CertificacionEnergetica/CCAA/Cautonomas/Decreto_6_2011_CastillaLaMancha.pdf				2011	Básica
Gobierno de España	Documento Básico HE. Ahorro de energía Con comentarios del MITMA. Guía de aplicación. DB-HE. Guía de aplicación del DB-HE 2019. DA. DB-HE/1. Cálculo de parámetros característicos de la envolvente. DA. DB-HE/2. Comprobación de limitación de condensaciones superficiales e intersticiales en los cerramientos. DA. DB-HE/3. Puentes térmicos. DB-HE.				2022	Básica

	Climas referencia. Documento descriptivo climas de referencia. https://www.codigotecnico.org/DocumentosCTE/AhorroEnergia.html		
Parlamento Europeo y del Consejo	Directiva 2010/31/UE, relativa a la eficiencia energética de los edificios. https://eur-lex.europa.eu/legal-content/ES/TXT/PDF/?uri=CELEX:32010L0031&from=ES	2010	Básica
Parlamento Europeo y del Consejo	Directiva 2012/27/UE, , relativa a la eficiencia energética. https://energia.gob.es/desarrollo/EficienciaEnergetica/directiva2012/Paginas/directiva-2012-27UE.aspx	2012	Básica
Gobierno de España	Real Decreto 235/2013, sobre el procedimiento básico para la certificación de la eficiencia energética de los edificio. http://www.boe.es/buscar/act.php?id=BOE-A-2013-3904	2013	Básica
Gobierno de España	Real Decreto 390/2021, sobre el procedimiento básico para la certificación de la eficiencia energética de los edificios https://www.boe.es/buscar/act.php?id=BOE-A-2021-9176	2021	Básica
Gobierno de España	Procedimientos reconocidos para la certificación energética de edificios y la verificación del cumplimiento del DB-HE Ahorro energético https://energia.gob.es/desarrollo/EficienciaEnergetica/CertificacionEnergetica/DocumentosReconocidos/Paginas/documentosreconocidos.aspx	2022	Básica