

**1. General information****Course:** ALTERNATIVE ENERGY**Type:** ELECTIVE**Degree:** 353 - UNDERGRADUATE DEGREE PROG. IN MECHANICAL ENGINEERING (CR)**Center:** 602 - E.T.S. INDUSTRIAL ENGINEERING OF C. REAL**Year:** 4**Main language:** Spanish**Use of additional languages:****Web site:****Code:** 56366**ECTS credits:** 6**Academic year:** 2022-23**Group(s):** 20**Duration:** First semester**Second language:** English**English Friendly:** Y**Bilingual:** N**Lecturer:** ANTOINE CLAUDE BRET . - Group(s): 20

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Politécnico/2-D13	MECÁNICA ADA. E ING. PROYECTOS	Via Teams	antoineclaud.bret@uclm.es	

**2. Pre-Requisites**

The student must possess the basic knowledge in Mathematics and Physics acquired in the first 3 years of college.

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

The energy/climate problem is one of the most important challenges facing humanity. Due to its numerous technological aspects, engineers must have an important role in overcoming it. Therefore, it is essential that they understand the problem and its various scientific aspects.

**4. Degree competences achieved in this course****Course competences**

Code	Description
A02	To know how to apply knowledge to work or vocation in a professional manner and possess the competences that are usually demonstrated by the formulation and defence of arguments and the resolution of problems in the field of study.
A03	To have the capability to gather and interpret relevant data (normally within the area of study) to make judgements that include a reflection on themes of a social, scientific or ethical nature.
A04	To be able to transmit information, ideas, problems and solutions to a specialized audience.
A08	Appropriate level of oral and written communication.
A10	Ability to produce and develop projects in the field of industrial engineering and automation aimed at, and in accordance with the knowledge acquired as established in section 5 of Order CIN/351/2009, the construction, remodelling, repair, conservation, demolition, manufacturing, installation, assembly or use of: structures, mechanical equipment, power installations, electrical and electronic installations, industrial plants and installations and processes of manufacture and automatization.
A12	Knowledge of basic materials and technologies that assist the learning of new methods and theories and enable versatility to adapt to new situations.
A16	Ability to analyse and evaluate the social and environmental impact of technical solutions.
C10	Basic knowledge and application of environmental technologies and sustainability.
F14	
F15	

**5. Objectives or Learning Outcomes****Course learning outcomes****Description**

Design of solar thermal energy systems applied to the production of domestic solar hot water, heating and cooling

Identify the basic elements of a wind farm. Calculate its principle parameters

Explain the applicable technologies for the use of hydrogen and its use in fuel cells. Applications of electrical generation and propulsion

Understand biomass energy production systems

**Additional outcomes**

Acquire a global vision of the energy/climate problem. Learn to find reliable information and calculate orders of magnitude. Understand the physical basis of climate change and the limitations of fossil fuels. Understand the physical basis of energy storage techniques. Know how to evaluate the potential of alternative energies from their physical basis. Develop energy scenarios for the future. Study historical precedents.

**6. Units / Contents****Unit 1: Introduction: what is the problem?****Unit 2: Fossil fuels****Unit 3: Climate science****Unit 4: Storage of energy, hydrogen**

Unit 5: Wind energy  
Unit 6: Solar energy  
Unit 7: Biomass, hydroelectricity, geothermal  
Unit 8: Nuclear Energy - Fission  
Unit 9: Nuclear Energy - Fusion  
Unit 10: Limitations and dangers  
Unit 11: Lessons from History

## 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	A02 A03 A04 A08 A10 A12 A16 C10 F14 F15	1	25	Y	N	
Problem solving and/or case studies [ON-SITE]	Problem solving and exercises	A02 A03 A04 A08 A10 A12 A16 C10 F14 F15	0.6	15	Y	N	
Computer room practice [ON-SITE]	Practical or hands-on activities	A02 A03 A04 A08 A10 A12 A16 C10 F14 F15	0.6	15	Y	N	
Final test [ON-SITE]	Assessment tests	A02 A03 A04 A08 A10 A12 A16 C10 F14 F15	0.2	5	Y	Y	
Individual tutoring sessions [ON-SITE]	Self-study	A02 A03 A04 A08 A10 A12 A16 C10 F14 F15	3.6	90	Y	N	
<b>Total:</b>			<b>6</b>	<b>150</b>			
<b>Total credits of in-class work: 6</b>			<b>Total class time hours: 150</b>				
<b>Total credits of out of class work: 0</b>			<b>Total hours of out of class work: 0</b>				

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
Oral presentations assessment	10.00%	10.00%	In continuous assessment, oral presentation (in group of 2) of a subject of free choice. In non-continuous evaluation, the oral presentation will be replaced by an additional practical test on the day of the ordinary exam.
Fieldwork assessment	45.00%	45.00%	In continuous evaluation, 3 reports of group practices. Each report counts for 15%. In non-continuous evaluation, the practice reports will be replaced by an additional practical test on the day of the ordinary exam.
Final test	45.00%	45.00%	In continuous assessment, it consists of several tests of solving theoretical-practical exercises similar to those carried out in the training activities throughout the course. In non-continuous evaluation, it will consist of solving the same exercises as continuous evaluation, on the day of the ordinary exam.
<b>Total:</b>	<b>100.00%</b>	<b>100.00%</b>	

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:

No minimum mark

#### Non-continuous evaluation:

No minimum mark

### Specifications for the resit/retake exam:

In order for the student to be able to achieve the maximum score, the extraordinary mark replaces all the marks.

## 9. Assignments, course calendar and important dates

Not related to the syllabus/contents	
<b>Hours</b>	<b>hours</b>
Final test [PRESENCIAL][Assessment tests]	5
<b>Unit 1 (de 11): Introduction: what is the problem?</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1
Individual tutoring sessions [PRESENCIAL][Self-study]	8
<b>Unit 2 (de 11): Fossil fuels</b>	
<b>Activities</b>	<b>Hours</b>

Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	2
Individual tutoring sessions [PRESENCIAL][Self-study]	8
<b>Unit 3 (de 11): Climate science</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	5
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1
Computer room practice [PRESENCIAL][Practical or hands-on activities]	5
Individual tutoring sessions [PRESENCIAL][Self-study]	10
<b>Unit 4 (de 11): Storage of energy, hydrogen</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1
Individual tutoring sessions [PRESENCIAL][Self-study]	8
<b>Unit 5 (de 11): Wind energy</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1
Computer room practice [PRESENCIAL][Practical or hands-on activities]	5
Individual tutoring sessions [PRESENCIAL][Self-study]	8
<b>Unit 6 (de 11): Solar energy</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1
Individual tutoring sessions [PRESENCIAL][Self-study]	8
<b>Unit 7 (de 11): Biomass, hydroelectricity, geothermal</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1
Individual tutoring sessions [PRESENCIAL][Self-study]	8
<b>Unit 8 (de 11): Nuclear Energy - Fission</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1
Individual tutoring sessions [PRESENCIAL][Self-study]	8
<b>Unit 9 (de 11): Nuclear Energy - Fusion</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1
Computer room practice [PRESENCIAL][Practical or hands-on activities]	5
Individual tutoring sessions [PRESENCIAL][Self-study]	8
<b>Unit 10 (de 11): Limitations and dangers</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1
Individual tutoring sessions [PRESENCIAL][Self-study]	8
<b>Unit 11 (de 11): Lessons from History</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	4
Individual tutoring sessions [PRESENCIAL][Self-study]	8
<b>Global activity</b>	
<b>Activities</b>	<b>hours</b>
Final test [PRESENCIAL][Assessment tests]	5
Class Attendance (theory) [PRESENCIAL][Lectures]	25
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	15
Computer room practice [PRESENCIAL][Practical or hands-on activities]	15
Individual tutoring sessions [PRESENCIAL][Self-study]	90
<b>Total horas: 150</b>	

10. Bibliography and Sources						
Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Jared Diamond	Collapse: How Societies Choose to Fail or Survive	Penguin		0241958687		
Joseph Tainter	The Collapse of Complex Societies	Cambridge Press		052138673X		
K. McGuffie, A. Henderson-Sellers	A Climate Modelling Primer	John Wiley & Sons		047085751X		
	The Energy-Climate Continuum.					

