25222 - Clean technologies. Renewable energies

Syllabus Information

Academic year: 2024/25
Subject: 25222 - Clean technologies. Renewable energies
Faculty / School: 201 - Escuela Politécnica Superior
Degree: 571 - Degree in Environmental Sciences
ECTS: 6.0
Year: 3
Semester: Second Four-month period
Subject type: Compulsory
Module:

1. General information

The aim of this subject is to introduce students to energy issues, with special emphasis on the environmental effects inherent to a specific energy technology. At the same time, it is also intended that students will be able to compare technological alternatives and propose corrective measures to reduce the environmental impact and/or improve the efficiency of a given energy transformation system.

The approach and objectives of the subject are aligned with some of the Sustainable Development Goals, SDGs, of the 2030 Agenda:

- *Goal 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all*
- *Goal 7: Ensure access to affordable, secure, sustainable and modern energy.*

It is recommended to have previously taken the subject "Bases of Environmental Engineering".

2. Learning results

Upon completion of the subject, the student will be able to:

1. -Identify the most important aspects related to energy issues and specify the environmental problems specific to each energy technology studied.

2. -Identify the operating variables that most affect the combustion process and synthesize the most important characteristics of the different types of combustors.

3. -Solve questions or problems related to the emission of pollutant gases (SO_2, NO_x etc.) that take place in a thermal conversion process.

4. -Analyse and evaluate information on different energy systems taking into account the geographical location.

5. -Dimension energy generation processes from fossil and renewable resources, and propose strategies for the energy efficiency of these processes

6. -Prepare and present orally the reports corresponding to the assigned work in a collaborative way.

3. Syllabus

Block I: renewable energies

Topic 1. Introduction: basic energy concepts, current energy context and energy planning.

Topic 2. Photovoltaic Solar Energy: semiconductors, photovoltaic panels, accumulation subsystems, regulation and power adaptation, sizing.

Topic 3. Solar thermal energy: applications, parabolic trough collectors, characteristic

parameters, solar tower power plants

Topic 4. Wind energy: wind resources, power produced by a wind turbine, wind machines, components of a wind turbine, applications and environmental impact.

Block II: clean technologies

Topic 5. Heat transfer (HT) mechanisms: overall HT coefficient, heat exchangers, heat loss quantification.

Topic 6. Energy and climate change: greenhouse gas (GHG) emissions.

Topic 7. Power generation from fossil resources: coal combustion, types of combustors, steam cycles and combined cycles, pollutant emission control, clean coal technologies.

Topic 8. Biomass as a renewable energy source: thermal conversion (combustion, pyrolysis and gasification), biofuels.

4. Academic activities

Theoretical classes (30 h) for the development of the contents of the proposed topics.

Practical sessions (20 h) related to the theoretical contents, where problems will be solved in a computer classroom.

Collaborative work (20 h), to be done in groups of 2-3 students and focused on the analysis of energy sources in a given system

Technical visits (4 h), subject to the budget available for their realization.

Personal study (70 h).

Assessment tests (6 h).

5. Assessment system

The subject will be evaluated in the **global evaluation** modality by means of the following activities:

1. Individual written test (70% of the final grade; minimum of 4 out of 10 points), consisting of a theory test (40% of the test grade) and a problem-solving test (60% of the test grade). A minimum mark of 3 over 10 points will be needed for each part. The evaluation criteria will be: approach, numerical solution, conceptual mastery and argumentative justification.

2. Evaluation of the cooperative work (30% of the final grade, minimum of 4 out of 10 points). During the last school days of the semester, the teams will be able to deliver the report of the work and make the oral presentation of the same during class time. The grade of the paper will be determined according to the quality of the written report and oral presentation, taking into account the following weights: 50% content, 30% presentation and defence, and 20% formal aspects . Students not evaluated in this activity - in the first or second call- will deliver the report and the presentation of the work through Moodle, with a deadline that will coincide with the official call. In justified cases, students may carry out the activity in the individual mode.

The final grade of the course will be calculated as the weighted average between the test (70% weight) and the cooperative work (30% weight). As stated above, a minimun mark of 4 points will be needed for each part. To pass the course, the final grade will have to be 5 points over 10 or more. If any of the two parts are passed (mark of at least 5 points), the mark obtained will be kept for the second call of the academic year.

La calificación final de la asignatura se determinará como la media ponderada entre la calificación obtenida en la prueba escrita (con un peso del 70%) y en el trabajo cooperativo (con un peso del 30%). Para poder promediar ambas calificaciones, será necesario una nota mínima de 4 sobre 10 puntos en cada una de las partes. Para superar la asignatura será necesario una calificación final igual a 5 puntos ó superior. Si se supera (con 5 puntos o más) alguna de las dos pruebas de evaluación, se guardará dicha calificación para la segunda convocatoria del curso académico.

Success rates in previous years: 2020-21 (63.41%); 2021-22 (65.52%); 2022-23 (68.42%).

6. Sustainable Development Goals

4 - Quality Education
7 - Affordable and Clean Energy