COURSE DATA

DATA SUBJECT

Code: 34889
Name: Renewable energies and their conditioning
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1403 - Degree in Telematics Engineering	Escola Tècnica Superior d'Enginyeria	3	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1403 - Degree in Telematics Engineering	Renewable energy and their conditioning	COMPULSORY

COORDINATION

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SUMMARY

The subject "Renewable Energy and its Conditioning" is part of the common block of specific matters of the branch of telecommunications. The subject is teached in the first quarter of the third year of the Degree in Telecommunication Electronics Engineering and the Degree in Telematics Engineering and as optional subject in the fourth year of the Degree on Industrial Electronics Engineering. The overall teaching load is 6 ECTS. The workload for the student is 150 hours over the semester: 90 hours of individual homework and 60 hours of classroom lessons.

In this subject the student will acquire the skill to specify, select and manage the various existing alternative energy sources, especially solar-thermal and photovoltaic. Also they learn about the principles of power electronics in order to define, design and project an alternative energy system level block diagram. The student will also learn to evaluate the technical, legislative, economic and environmental impact of these energy sources.

The general objectives of the subjet are to provide students with the necessary knowledge to understand the working principle and different applications of existing alternative energy sources with particular

emphasis on solar thermal and photovoltaic. Students will learn the rules applicable to facilities based on renewable energy and will have the ability for sizing the solar power plants (both photovoltaic as solar thermal of low temperature).

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

The needed background to follow the course of the subject are acquired in the subjects of "physics" and "Electronic Circuits" that are taught in first course of the Degree and "Electronic and photonic devices" that is taught in second course.

COMPETENCES / LEARNING OUTCOMES

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G3 - Acquisition of the knowledge of the basic and technological subjects that allows students to learn new methods and theories and endows them with the versatility to adapt to new situations.

G5 - Knowledge to carry out measurements, calculations, assessments, evaluations, loss adjustments, studies, reports, task planning, and other analogous work in the specific field of telecommunications.

G7 - Ability to analyze and assess the social and environmental impact of technical solutions.

R11 - Ability to use different sources of energy, especially solar photovoltaic and thermal, as well as the fundamentals of electrotechnics and power electronics.

DESCRIPTION OF CONTENTS

1. INTRODUCTION TO RENEWABLE ENERGY

(3 contact hours of theoretical clases and 2 hours for individual homework)
1.1. Concept of renewable energy.
1.2. Classification of renewable energy.
1.3. Impact on energy saving and the environment.
1.4. Governing Law.
 1.4.1. European Directives.
 1.4.2. National Energy Plan.

2. SOLAR RADIATION

(3 contact hours of theoretical clases and 4 hours for individual homework)
2.1. Solar radiation. Spectrum of solar radiation.
2.2. Solar radiation at the surface of the earth.
  2.2.1. Variation of radiation
  2.2.2. Terrestrial coordinates.
  2.2.3. Movements of the earth.
  2.2.4. Radiation on a flat surface.
  2.2.5. Radiation on an inclined plane.
2.3. Measuring apparatus.

3. SOLAR THERMAL ENERGY

(10 contact hours of theoretical clases and 12 hours for individual homework)
3.1. Main elements of a low temperature solar thermal system.
  3.1.1. Solar collectors. Efficiency.
  3.1.2. Distribution system.
  3.1.3. Storage system.
  3.1.4. Conventional support system.
3.2. Types of low temperature solar systems.
3.3. Applications of low temperature solar thermal energy: Heating and domestic hot water (DHW).
3.4. Sizing of facilities and applicable regulations.
3.5. Medium and high temperature solar thermal energy. Applications.

Practical classes (problems): 5 hours in classroom and 6 hours for homework.

PRACTICE 1 (3 contact hours and 1 hour for individual homework): Efficiency of a low temperature solar collector.

PRACTICE 2 (3 contact hours and 1 hour for individual homework): Dynamic simulation to design and optimize a solar thermal DHW installation by using commercial software.

PRACTICE 3: Mini-Project of a solar termal installation (3 contact hours for all the presentations and 10 hours for work in group): Calculation and dimensioning of a solar thermal ACS installation.

4. PHOTOVOLTAIC ENERGY

(10 contact hours of theoretical clases and 12 hours for individual homework)
4.1. Photovoltaic panels.
4.1.1. Components of a panel.
4.1.2. Manufacture of panels.
4.1.3. Characterization of the panel: current-voltage curves and its dependence on temperature and the incident radiation.
4.1.4. Panel efficiency.
4.1.5. Types of panels.
4.1.6. Certification procedure.
4.2. Photovoltaic systems.
4.2.1. System Components: Batteries, regulators, DC/DC converters, inverters (DC/AC).
4.2.2. Types of photovoltaic systems.
4.2.2.1. Centralized and decentralized autonomous photovoltaic system.
4.2.2.2. Grid connected photovoltaic system.
4.2.2.3. Hybrid system.
4.3. Applications.
4.4. Sizing of facilities and applicable regulations.

Practical classes (problems): 5 hours in classroom and 6 hours for homework.

PRACTICE 4 (3 contact hours and 1 hours for individual homework): Electrical charaterization of a photovoltaic installation. Part I.

PRACTICE 5 (3 contact hours and 1 hours for individual homework): Electrical charaterization of a photovoltaic installation. Part II.

PRACTICE 6 (3 contact hours and 1 hours for individual homework): Dynamic simulation to design and optimize an autonomous photovoltaic solar installation by using commercial software.

5. OTHER RENEWABLE ENERGY SOURCES

(4 contact hours of theoretical clases and 5 hours for individual homework)

5.1. Wind energy.
5.2. Biomass.
5.3. Energies from the sea. Geothermal and hydroelectric energy.
5.4. Fuel cells.
5.5. Aerothermal systems.

PRACTICE 7 (2 hours in classroom and 8 hours of work in group): Presentation of some type of renewable energy (wind energy, biomass, energies from the sea, geothermal energy, hydroelectric energy, fuel cells or aerothermal).

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	30,00
Laboratory	20,00
Classroom practices	10,00
Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	18,00
Independent study and work	20,00
Preparation of lessons	52,00
Preparation for assessment activities	0,00
Resolution of case studies	0,00
Total hours	**90,00**

TEACHING METHODOLOGY

The development of the course is structured around three axes: learning with the teacher (theory sessions, workshop and problems), laboratory sessions and performing a mini-project.

a) Learning in group with the teacher

In the theory sessions will use the lecture model. The professor exposes the fundamental contents of the course (G3, R11), using the media at their disposal (presentations, transparencies, blackboard).

In the problem sessions, the professor will explain several problems corresponding to topics 3 and 4 (G5, R11).

The theoretical concepts introduced in lectures will be complemented by performing a seminar-workshop (G7, R11). This seminar will be prepared by all students organized into small groups (2-4 students). The work will be presented in class laboratory and evaluated both the quality of the presentation and the response to the questions made by the teacher and other students.

b) Laboratory sessions

Lab sessions are aimed to analyse the behaviour of solar thermal collectors and solar panels, and the management of dynamic simulation tools to design and optimize a solar thermal SHW installation or an autonomous solar photovoltaic installation (G3, G5, R11).

These lab sessions will be organized around working groups of a maximum of two people.

c) Completion of a mini-project (work in group)

The same groups that were formed to carry out the seminar-workshop (2 to 4 students) must prepare a mini-project based on the calculation and dimensioning of a solar domestic hot water installation (G5, G7, R11). Each team must submit a copy of their project that will also be presented and defended.

Individual mentoring

Students will have a schedule of individual mentoring whose purpose is to solve problems, questions, guidance on homeworks, etc. The schedule will be indicated at the beginning of the academic course. The students will also have the opportunity to clarify some questions via email or discussion forums by using the tool "Aula Virtual" which is provided by the University of Valencia.

EVALUATION

The knowledge acquired by the student may be assessed in one of the following two ways: through continuous assessment or through a single final assessment. In second call, students will always be assessed through the single final assessment modality.

Throughout the course, students are required to complete both a Mini-Project and a Workshop Seminar (ST). The Mini-Project (evaluation of competencies G5, G7 and R11) will be assessed based on two components: the presentation and oral defence using PowerPoint (MP-EXP), and the submitted technical documentation (MP-DT). The final Mini-Project grade will be the average of the scores from both components. To pass the course, students must achieve a minimum score of 4 out of 10 on the Mini-Project. The presentation and defence (MP-EXP) is considered a non-recoverable activity. All members of a group will receive the same grade for this part.

The Workshop Seminar (ST) will be evaluated based on the level of preparation, presentation quality (PowerPoint), clarity of delivery, and accuracy during the Q&A session (evaluation of competencies G5, G7 and R11). Like the Mini-Project presentation, the Workshop Seminar is also considered a non-recoverable activity, and all group members will receive the same grade.

To pass the course, students must attend more than 80% of the laboratory sessions.

Continuous Assessment System

Throughout the course, two midterm exams will be held (evaluation of competencies G5, G7 and R11): the first one (CTR1) in the middle of the semester, and the second one (CTR2) on the date set by the Centre for the first call exam.

The first midterm exam (CTR1) will include theoretical-practical questions from Topics 1, 2, and 3, as well as a sizing problem of a solar thermal installation (Topic 3). This exam will be compensable if the grade is equal to or higher than 4 out of 10.

The second midterm exam (CTR2) will include theoretical-practical questions from Topic 4 and from the section on aerothermal systems in Topic 5, as well as a sizing problem of a photovoltaic system (Topic 4). This exam will be compensable if the grade is equal to or higher than 4 out of 10.

CTR1 will account for 40% of the final grade, and CTR2 will account for 30%.

The laboratory grade (LAB) will be based on the following two assessments:

a) Practical Session Grade (SP), which will represent 30% of the LAB grade. This will evaluate the student's interest and demonstrated skills, proficiency in the use of laboratory equipment and software tools, and the development of the lab activity throughout the session. This is a non-recoverable activity.

b) Two laboratory midterms (Lab1 and Lab2), which together will represent 70% of the LAB grade. Lab1 will be held mid-semester and will be compensable if the grade is equal to or greater than 4 out of 10. Otherwise, the student must take a comprehensive laboratory exam (Lab1 + Lab2) during the official exam period. Lab2 will take place on the date set by the Centre for the first official call. On that same date, students who did not achieve a compensable grade in Lab1 must also take the full laboratory exam (Lab1 + Lab2).

Thus, the LAB grade, which will represent 15% of the final course grade, will be calculated as follows:

LAB = 0.3 × SP + 0.35 × Lab1 + 0.35 × Lab2

A minimum grade of 4 out of 10 in the LAB component is required to pass the course.

Thus, the final course grade will be calculated as follows:

Final Mark = 0,40 x CTR1 + 0,30 x CTR2 + 0,15 x LAB + 0,10 x (MP-EXP+MP-DT)/2 + 0,05 x ST

Final Assessment System

It is based on a Final Theory-Problems Exam (EF), taken in both the first and second call, with a total weight of 70% (assessment of competencies G3, G5 and R11). In the first call, this assessment method must be

followed by students who did not obtain a grade equal to or higher than 4 out of 10 in CTR1.
It is mandatory to obtain a minimum score of 4 out of 10 on this Final Exam to pass the course.

Both in the first and second call, the laboratory grade (LAB) will be obtained through a final exam (Lab1 + Lab2), together with the grade of the Practical Session (SP), weighted as follows:

LAB = 0.3 × SP + 0.7 × (Lab1 + Lab2) / 2

A minimum score of 4 out of 10 in the LAB part is mandatory to pass the course.

If the minimum Mini-Project grade of 4/10 is not achieved in the first call, the technical documentation (MP-DT) must be resubmitted for evaluation in the second call. In this case, the grade obtained in the presentation and public defence of the Mini-Project (MP-EXP) during the first call will be retained.

The final mark of the subject will be obtained in the form:

Final Mark = 0,7 x EF + 0,15 x LAB + 0,10 x (MP-EXP+MP-DT)/2 + 0,05 x ST

Advance call assessment

To request for an advanced call, students must have done the practical sessions and must submit the required MP and ST documentation.

In any case, the evaluation system will be set by " Reglamento de Evaluación y Calificación de la Universidad de Valencia para Grados y Masters: (https://webges.uv.es/uvTaeWeb/MuestraInformacionEdictoPublicoFrontAction.do?accion=inicio&idEdictoSeleccionado=5639).

Copying or plagiarism of any activity that is part of the evaluation will result in the impossibility of passing the course, and the student will then be subject to the appropriate disciplinary procedures indicated in the ACTION PROTOCOL FOR FRAUDULENT PRACTICES AT THE UNIVERSITY OF VALENCIA. (ACGUV 123/2020).

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