Subject	FUNDAMENTALS OF SOLAR CELLS
Credits	6 ECTS (3T+3P)
Character	Compulsory
Semester	1st
Language	English

Competences

CG3 - Creativity: To conceive, develop and validate new systems that can increase the quality of life of people; to carry out, inacademic and professional contexts, innovations or technological advances that can advance the state of the art

CG5 - Informationmanagement: to search for and manage appropriate bibliographic resources efficiently, to learn to continue studies in a largelyautonomous way as a basis for future research and innovation activity

CG8 - Apply methodologies,procedures, tools and state-of-the-art standards for the creation of new technological components; build new hypotheses andmodels, evaluate them and apply them to problem solving

CG9 - Communicate judgments and knowledge to specialized and non-specialized audiences in a reasoned, clear andunambiguous manner.

CB6 - Possess and understand knowledge that provides a basis or opportunity to be original in the development and/or application of ideas, often in a research context

CB7 - Students should be able to apply their acquired knowledge and problem-solving skills in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study.

CB8 - Students are able to integrate knowledge and face the complexity of making judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities related to the application of their knowledge and judgments

CB10 - That students possess the learning skills that will enable them to continue studying in a manner that will be largely self-directed or autonomous..

CT3 - Use of the English language: understand the contents of lectures, conferences and seminars in English; write reports and scientific-technical articles in English using computer tools; make public presentations in English of research work, results and conclusions, for example, in the subjects of the Master or in congresses of a mostly international nature or in stays in foreign centers, all with the help of audiovisual computer media

CT4 - Team leadership: tocarry out team work (such as those of some of the evaluation activities of the subjects), to integrate into a research group by activelyparticipating in its meetings, collaborating with own initiative in R+D+i works or projects; to interact effectively with the membersof the multidisciplinary work team.

CE1 - Understanding, analyzing and judging the relevance of any contribution in this field, in relation toits social, energetic and scientific-technical environment.

CE2 - Knowledge, analysis and proposals of new concepts, methods or devices for photovoltaic conversion.

CE3 - Realization,development and innovation of technological processes for the manufacture of photovoltaic devices.

Outcomes

RA04 - Ability to analyze the results

RA25 - Ability to understand the basic operation of different types of solar cells, both current and those that will emerge in the near future.

RA24 - Knowledge of the physical fundamentals of solar cells.

RA32 - Ability to analyze and measure the i-v curves of solar cells.

RA33 - Training in the practical aspects of solar cell characterization.

RA36 - Knowledge of the physical effects that allow the use of solar energy

RA37 - Understand the relevant physical principles that affect the operation of solar cells.

RA39 - Ability to understand the physical fundamentals of current and new generation solar cells.

Description and syllabus

The course aims to present the physical principles of operation and model descriptions of photovoltaic converters (solar cells).

First, the current-voltage characteristic of a solar cell and its main parameters such as open-circuit voltage, short-circuit current and form factor are described. Then its equivalent circuit and the analysis of each of the elements of this circuit and the influence of external parameters on the I-V characteristic are presented. Finally, an overview of the different types and technologies of solar cells is given and an introduction to new technologies is made.

Throughout the course, laboratory practices are carried out so that the students have a direct experience of the concepts presented.

Schematically, the syllabus includes:

1. Introduction to solar cells: current-voltage characteristic.
2. The equivalent circuit
3. Quantum efficiency and spectral response
4. Series and parallel resistance
5. Irradiance and temperature effects
6. Types of solar cellsa.
    - Silicion.
    - Thin films
    - Multijunctions.
    - Other cell types

Laboratory practices:

1. Preliminary issues: laboratory safety and etiquette
2. The solar cell. Morphological characterization

3. Basic instrumentation and methods for measuring a solar cell I-V curve.
4. Influence of irradiance and temperature on the I-V curve.
5. Influence of series and parallel resistances on the I-V curve.
6. Influence of spectrum on the photocurrent of a solar cell.
7. I-V curve fitting