Subject	SOLAR CELL SIMULATION LABORATORY
Credits	3 ECTS (3P)
Character	PV-cells track
Semester	2nd
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 – Information management: to search for and manage appropriate bibliographic resources efficiently, to learn to continue studies in a largely autonomous 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 and models, evaluate them and apply them to problem solving.

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

CB9 - Students should be able to communicate their conclusions and the ultimate knowledge and rationale behind them to specialized and non-specialized audiences in a clear and unambiguous manner

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

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.

Outcomes

RA3 - Knowledge of the most commonly used simulation tools for photovoltaic cells and systems.

RA4 - Ability to analyze the results

RA5 - Relate the basic principles with practical aspects

RA24 - Knowledge of the physical fundamentals of solar cells

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

RA27 - Critical ability to analyze different models in terms of basic physics principles.

Description and syllabus

This course introduces the student to the simulation of solar cells and presents different software tools frequently used in this field. The main objective of the course is to train in the use of the software tools and to develop the student's capabilities in the analysis, design and optimization of photovoltaic devices.

The software used in the course includes PC1D, SCAPS and Microcap (SPICE). The contents are grouped into thematic blocks, simultaneously reviewing theoretical concepts and introducing novel practical aspects, in the form of hands-on exercises covering a wide range of topics, from the fundamentals of charge carriers at the microscopic level to the prediction of energy production in cells. This course follows the flipped classroom methodology.

Schematically, the syllabus includes:

1. Silicon cells: emitter optimization; sheet resistance; front-end mesh and general figures of merit

2.. Thin film solar cells: Diagnostics, advanced simulation and optimization.

3. Equivalent circuit of a solar cell: cell model, interconnection, mismatch losses and optimization.