

Module PRE710

Basics of Photovoltaics

This module is associated to the following degrees

Master > Renewable Energy Online > Mandatory Module

Abstract:

This course covers the physics of photovoltaic devices where we discuss the solar cell from a microscopic point of view to explain the macroscopic behaviour of solar cells. We discuss design and optimization strategies as well as the limits of solar cells, various technologies and materials which are on the market. . In the practical part of the module, calculation exercises will be given to complement the new theoretical knowledge. Additionally, the students will simulate solar cells and their behaviour under varying conditions using a research based simulation software.

Duration:	1 semester	Teaching form:	Lectures, Seminar
Cycle:	Summer Semester	Language:	English
Type of module:	Compulsory	Credit points:	6 ECTS
Level:	MM (master module)	Workload:	180 hours
Max. No. of students:	30	Pre-requisites:	none
Weblink:	n/a	Associated with the module(s):	n/a
Lecturer(s): Robin Knecht, Angelika Basch	Mentor(s): Mónica Gutiérrez, Adnan Shihab		
Designer(s) of the module: Robin Knecht	Examiner(s): Robin Knecht, Angelika Basch		

Objective of the module / learning outcomes:

After successful completion of the module students should be able to:

- describe schematically the events around the pn-junction under bias in the dark and under illumination
- compute and discuss the mismatch factor from IV data
- perform a basic simulation of a solar cell and its behaviour under varying conditions
- apply solar cell data sheets in their professional career
- discuss the concepts of solar cell materials, design and optimization
- discuss the limitations of solar cells and reflect on needed resources and linked environmental effects

Forms of learning:

The learning process will be predominantly based on reading material (self-learning) and applying new knowledge in practical exercises and simulation tasks, which are designed to complement the content of each chapter of the module. The students will be supported by lecturers and mentors using forums, messages and video conferences for active discussions and constant contact to address questions and any type of difficulties.

<p>Helpful previous knowledge:</p> <ul style="list-style-type: none"> - Mathematics for physics and engineering 			
<p>Content of the module:</p> <ul style="list-style-type: none"> - Macroscopic Solar cell behaviour - Physics of semiconductor materials - Pn-Junctions in the dark or under illumination with or without voltage bias - Characterization of Solar Cells - Simulation of solar cells - Design, Optimization, Limits - Photovoltaic materials (Silicon, III-V, a-Si, CdTe, CIGS, Organic PV, dye-sensitized PV, Perovskite, ...) - Applications of solar cells: Overview and Outlook 			
<p>Useful literature:</p> <ul style="list-style-type: none"> - S. Hegedus, A. Luque, Handbook of Photovoltaic Science and Engineering, (2nd Edition, 2011) John Wiley and Sons - Ch. Honsberg, S. Bowden, PVCDROM, http://www.pveducation.org/pvcdrom/instructions, Access date 2.10.2014 - J. Nelson, Physics of Solar Cells, (1st Edition, 2003), Imperial College Press - lecture notes for the respective courses 			
<p>Requirements for awarding the credit points</p> <p>Practical exercises: Submission of the solutions of the calculation exercises and simulation tasks in due time. Each set of tasks will be graded. The average of the grades obtained during its duration will be calculated, giving the final grade.</p>			
<p>Examination periods:</p> <p>Tasks corresponding to each chapter will be given to the students. The tasks are designed to be solved in two weeks' time frame. Deadlines to deliver the tasks will be at the end of each month.</p>			
<p>Comments:</p> <p>none</p>			
Registration procedure:	C3LLO	Last update:	03.08.2018