GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00051807		
Field of study	Technical Physics		
Date of commencement of studies	February 2027	Academic year of realisation of subject	2027/2028
Education level	second-cycle studies	Subject group	
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	2	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Division of Physics of Organic and Perovskite Photovoltaic Structures -> Institute of Physics and Applied Computer Science -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Damian Głowienka	
	Teachers	dr inż. Damian Głowienka	

Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	0.0	0.0	30.0	0.0	0.0	30
	E-learning hours included: 0.0						

Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
	Number of study hours	30	3.0	17.0	50

Subject objectives	The course aims to develop skills in measuring and analyzing JV characteristics of various types of solar cells and in the fabrication of dye-sensitized solar cells.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W05] understands the physical principles underlying the operation of scientific equipment and the processes occurring throughout its life cycle.	The student knows the physical principles of equipment used for solar cell characterization, including setups for JV measurements, light and temperature control, and basic DSSC preparation. The student understands the importance of proper setup configuration, stable measurement conditions, and equipment limitations for reliable evaluation of photovoltaic parameters.	[SW3] Assessment of knowledge contained in written work and projects
[K7_W06] possesses advanced knowledge of experimental methods and techniques in physics, as well as occupational health and safety principles enabling independent work at research or measurement workstations.	The student knows advanced experimental methods used in photovoltaic laboratories, in particular JV measurements of different types of solar cells and the analysis of the influence of illumination, temperature, and shading on their operation. The student knows safety rules required for working with measurement setups, light sources, electrical circuits, and during the fabrication of dye-sensitized solar cells.	[SW1] Assessment of factual knowledge
[K7_U03] is capable of conducting advanced laboratory work in physics and related disciplines, selecting and adapting appropriate methods and tools, and critically evaluating existing technical solutions.	The student is able to independently perform JV measurements of photovoltaic cells and modules and determine basic operating parameters such as UOC, ISC, MPP, FF, Rs, and Rsh. The student can critically analyze results, assess the influence of experimental conditions on the shape of the characteristics, and identify possible measurement and technological error sources.	[SU1] Assessment of task fulfilment
[K7_U08] is capable of designing and constructing devices, measuring instruments and technical systems based on physical principles, using appropriately selected advanced methods, techniques, tools and materials.	The student is able to assemble and adapt a simple measurement setup for solar cell testing by selecting appropriate components, load configuration, and measurement conditions. The student can fabricate a dye-sensitized solar cell and evaluate the influence of layer preparation quality and electrical contacts on the performance of the obtained device.	[SU1] Assessment of task fulfilment

Subject contents

Course content – laboratory

1. Preparation of the list of required tests and planning of the experimental process in accordance with the research objective.
2. Conducting the fabrication process of dye-sensitized solar cells.
3. Performing electrical measurements.
4. Analyzing the results and drawing conclusions.
5. Preparing a written report.

Prerequisites and co-requisites

Knowledge of the fundamental physical phenomena occurring in solar cells. Theoretical knowledge of the basic principles of solar cell operation and fabrication technology is also required. In addition, the student should be able to carry out measurements of electrical quantities, analyze them, and present the results.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Evaluation of a written report on the course of research and its results.	50.0%	100.0%

Recommended reading

Basic literature	[1] W. Shockley, H. Queisser, Detailed balance limit of efficiency of pn junction solar cells, Journal of Applied Physics 32 (2) (1961) 510-518. [2] P. Würfel, Physics of Solar Cells From Principles to New Concepts, WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim 2005.
Supplementary literature	1. Handbook of photovoltaic science and engineering, ed. by Antonio Luque and Steven Hegedus,2011 John Wiley & Sons, Ltd

	eResources addresses	
Example issues/ example questions/ tasks being completed	1. Preparation of the list of required tests and planning of the experimental process in accordance with the research objective. 2. Conducting the fabrication process of dye-sensitized solar cells. 3. Performing electrical measurements. 4. Analyzing the results and drawing conclusions. 5. Preparing a written report.	
Practical activites within the subject	Not applicable	

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