GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Technology of Photovoltaic Cells and Thermophotovoltaics, PG_00067894		
Field of study	Technical Physics		
Date of commencement of studies	February 2026	Academic year of realisation of subject	2026/2027
Education level	second-cycle studies	Subject group	Specialty 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	15.0	0.0	0.0	0.0	15.0	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	4.0	16.0	50

Subject objectives

To acquaint students with the technology of solar cells and thermophotovoltaics

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U07] has enhanced skill of preparing speeches in Polish and English, including presentation of own research results	The student is preparing a seminar on the specific topic in the field of photovoltaic cell production based on scientific literature	[SU5] Assessment of ability to present the results of task
[K7_K01] knows limitations of own knowledge, understands the need to learn and improve professional and personal competencies	The student learns the basics of operation of a photovoltaic and thermophotovoltaic cell, as well as their wide application in industry	[SK5] Assessment of ability to solve problems that arise in practice
[K7_W03] has knowledge of current development paths and discoveries in the scope of physics and related fields of science and technology	During the lecture, technological innovations in laboratory and industrial research for photovoltaic and thermophotovoltaic cells will be presented.	[SW1] Assessment of factual knowledge

Subject contents

Course content – lecture

1. Processes involved in energy conversion.
2. Fundamentals of photovoltaic and thermophotovoltaic cell operation.
3. Basic parameters characterizing a solar cell.
4. Methods for characterizing photovoltaic cells.
5. ShockleyQueisser (S-Q) limit.
6. Fundamental parameters limiting the efficiency of photovoltaic and thermophotovoltaic cells.
7. Structure and technology of single-junction solar cells.
8. Photovoltaic modules.

Course content – seminar

1. Silicon solar cell a step in the manufacturing process
2. CIGS why isnt there mass production?
3. Organic solar cells one large-scale manufacturing technique
4. Organic solar cells have they already been completely replaced by perovskite materials?
5. Perovskite solar cells what has made them so popular?
6. Perovskite solar cells what technological stage are we at?
7. Organic vs. perovskite solar cells what are the differences in stability testing?
8. How does the manufacturing technology of silicon and perovskite solar modules differ?
9. Tandem cells what is the technological limit on the number of junctions?
10. Encapsulation methods which approach is most effective for flexible cells?

Prerequisites and co-requisites

A basic understanding of semiconductor physics and solar-cell operation is required.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
oral presentation	100.0%	40.0%
Passing the exam	50.0%	60.0%

Recommended reading

Basic literature

[1] W. Shockley, H. Queisser, Detailed balance limit of efficiency of p-n 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.

[3] A. Luque, S. Hegedus, Handbook of Photovoltaic Science and Engineering, John Wiley & Sons Ltd, England 2003.

[4] Thomas Bauer Thermophotovoltaics. Basic Principles and Critical Aspects of System Design

[5] Donald Chubb Fundamentals of Thermophotovoltaic Energy Conversion

Supplementary literature: M. Wacławek, T. Rodziewicz, "Ogniwa słoneczne" WNT Warszawa 2011

eResources addresses:

Example issues/ example questions/ tasks being completed

1. Describe the models of free charge-carrier recombination in solar cells.

2. How does an organic solar cell differ from a perovskite solar cell? Explain based on the operating mechanisms of these two types of cells.

3. Describe the difference between a solar cell, a module, and a solar panel.

4. Name and describe the basic elements of a thermophotovoltaic cell?

Practical activites within the subject	Not applicable

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