GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00065835		
Field of study	Materials Engineering		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2025/2026
Education level	second-cycle studies	Subject group	Specialty subject group Subject group related to scientific research in the field of study
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	Institute of Nanotechnology and Materials Engineering -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Maria Gazda	
	Teachers	prof. dr hab. inż. Maria Gazda	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	0.0	0.0	5.0	20

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	20	5.0	25.0	50

Subject objectives

The aim of the course is to learn about the materials and technologies used in the conversion of light into other forms of energy, especially electricity.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U06] Can evaluate usefulness and feasibility of using new achievements (techniques and technologies) within the scope of materials science.	is able to assess the usefulness and possibility of using new achievements in materials and technologies for photovoltaics	[SU1] Assessment of task fulfilment
[K7_W01] Has extended knowledge of the fields of science and scientific disciplines relevant to materials engineering, and their historical development and importance for the progress of exact and natural sciences, knowledge of the world and evolution of humanity.	has extensive knowledge of materials engineering, its importance and impact on the development of new energy sources, especially photovoltaics	[SW1] Assessment of factual knowledge

<table>
<tr><td>Subject contents</td><td>Course content – lecture
Lecture

Introduction:1) Optical properties of materials: absorption, refraction and reflection coefficient;2) Generation and recombination of charge carriers in a semiconductor;3) Internal photoelectric effect;Principle of operation of a photovoltaic cell:1) Phenomena;2) Energy conversion efficiency;3) Factors influencing energy conversion efficiency;Photovoltaic cell design, materials used and solutions on the example of a silicon cell: 1) Emitter and base;2) Antireflection layers;3) Electrodes;4) Amorphous silicon thin-film cells;Other materials and technologies:1) CdTe thin-film cells, CIGS, perovskite cells;2) Photoelectrochemical cells, biocells;3) Multi-junction cells;4) Light focusing;

Solar panels:1) Materials and solutions used in panels;2) Application of panels;3) Comparison of different technologies; Other devices using the internal photoelectric effect (photoresistors, photodiodes) and materials and technologies used to manufacture them.

Summary: limitations, perspectives, applications

Seminar: Discussion between students on issues related to the use of photovoltaic cells, the profitability of their use, forecasts for the future and problems related to their recycling.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Basic knowledge on semiconductors</td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>written work: open questions</td><td>51.0%</td><td>90.0%</td></tr>
<tr><td>presence and presentation assesment</td><td>51.0%</td><td>10.0%</td></tr>
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<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>https://epodreczniki.open.agh.edu.pl/handbook/35/module/1079/reader</td></tr>
<tr><td>Supplementary literature</td><td>scientific literature</td></tr>
<tr><td>eResources addresses</td><td>Basic
https://epodreczniki.open.agh.edu.pl/handbook/35/module/1079/reader - e textbook, AGH</td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>1. List the methods for increasing the efficiency of a silicon photovoltaic cell. Describe one of these methods in bullet points.2. List thin-film cells and describe one of them. Why can't poly- or monocrystalline silicon cells be manufactured as thin-film cells?3. The main parts of a silicon photovoltaic cell are the n-type layer (emitter) and the p-type layer (base). Explain why the emitter must be heavily doped and have a thickness of about 0.5 m.4. What materials, apart from silicon, are used in a silicon photovoltaic cell? What functions do these materials perform?</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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