



Subject card

Subject name and code	Photovoltaic systems, PG_00064055						
Field of study	Technical Physics						
Date of commencement of studies	October 2024		Academic year of realisation of subject		2026/2027		
Education level	first-cycle studies		Subject group		Optional 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	3		Language of instruction		Polish		
Semester of study	6		ECTS credits		3.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	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. Justyna Lubośna				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	15.0	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		5.0		40.0	75
Subject objectives	<p>- teach students how photovoltaic on-grid and stand-alone systems are constructed. Discuss main problems regarding the performance of such installations</p> <p>- teach students how to design and properly locate PV systems, and how to assess their costs and cash flow</p> <p>- teach students how to use the PVSOL premium software</p>						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_K04] cooperate and work in a group, performing different functions		WRONG LEARNING OUTCOME		[SK1] Assessment of group work skills		
	[K6_U06] makes an initial economic analysis of undertaken engineering activities		The student can estimate the PV investment cost. Knows legal and other barriers (related to the functioning of the Energy Markets) hampering the calculation of profits and the payback period.		[SU1] Assessment of task fulfilment		
	[K6_W01] understands the importance of physics and its applications in connection to civilization		The student knows the physical, economic and ecological aspects of photovoltaic systems.		[SW3] Assessment of knowledge contained in written work and projects		

Subject contents	<p>Course content – lecture</p> <p>properties of solar radiation relevant for photovoltaic applications</p> <p>potential of photovoltaic installations in Poland, Europe and worldwide, with special emphasis on the potential of solar cell applications in Poland with respect to other EU countries</p> <p>solar panel testing conditions and their effect on photovoltaic parameters of these devices</p> <p>optimal solar panel tilt and azimuth angles depending on geographic location, season and climate</p> <p>increase in total power production resulting from the use of tracking systems of various types</p> <p>basic photovoltaic parameters of individual cells and photovoltaic modules</p> <p>problems related to the operation of solar batteries - analysis of current-voltage characteristics of cells, modules and PV panels</p> <ul style="list-style-type: none"> - influence of external conditions (light intensity, temperature) - consequences of connecting cells into circuits of different configurations (solar modules, panels and arrays) - maximum power point tracking (MPPT) - selection of a PV technology proper for a given external load <p>construction of PV modules - problems and methods of their elimination</p> <p>the issue of partial shading of a PV installation and its influence on MPPT</p> <p>other elements of on-grid photovoltaic systems and off-grid island installations:</p> <ul style="list-style-type: none"> - batteries - types, functions, construction, principles of operation, lifetime - charge controllers - types, functions, charging methods and charging rates - inverters - types, functions, construction, operation principles - DC-DC converters - external loads - cabling - security and mounting of PV modules and panels - working conditions of PV installation components - examples of devices available on the market and their estimated costs <p>proper selection of elements of stand-alone installations and on-grid systems</p>
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	tools used to support the design process of photovoltaic power systems		
	design and cost-benefit analysis of on- and off-grid installations using appropriate software		
	Course content – project Design of two solar cell systems: small scale solar installation and a PV power plant.		
Prerequisites and co-requisites	Knowledge on photovoltaic effect and operating principles of inorganic solar cells.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	project of a PV system	50.0%	100.0%
Recommended reading	Basic literature	Arnulf Jäger-Waldau, Snapshot of photovoltaics, EPJ Photovoltaics 16 , 22 (2025)	
		Bogdan Szymański, "Instalacje fotowoltaiczne", Geosystem, 2016	
		Shree Raj Shakya, Dinesh Kumar Sharma, Training Manual for Engineers on Solar PV System, 2011	
		J.M. Pearce and R. Andrews, Engineering Photovoltaic Systems, 2010	
		Roger Messenger, Amir Abtahi, Photovoltaic Systems Engineering, CRC Press, 2010	
	Supplementary literature	James P. Dunlop, NJATC, Photovoltaic Systems	
	eResources addresses		
Example issues/ example questions/ tasks being completed	Series and parallel connection of cells (modules, panels, arrays). Choice of modules suitable for the load. Maximum power point tracking. Module shading. Blocking and by-pass diodes.		
Practical activities within the subject	Not applicable		

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