



Subject card

Subject name and code	Optical Spectroscopy in Photovoltaics, PG_00039462						
Field of study	Technical Physics						
Date of commencement of studies	February 2024	Academic year of realisation of subject			2023/2024		
Education level	second-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	1	Language of instruction			Polish		
Semester of study	1	ECTS credits			1.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Physics of Electronic Phenomena -> Faculty of Applied Physics and Mathematics						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Jędrzej Szmytkowski					
	Teachers	dr hab. inż. Jędrzej Szmytkowski					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	0.0	0.0	15
	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	15		2.0		8.0	25
Subject objectives	Demonstration of spectroscopy methods used to study phenomena occurred in photovoltaic cells						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K7_W03] Has general knowledge of current development paths and discoveries in the scope of physics and related fields of science and technology.	Student knows new trends in modern physics			[SW1] Assessment of factual knowledge		
	[K7_K01] Knows limitations of own knowledge. Understands the need to learn and improve professional and personal competencies.	Student understands that he should learn during his life			[SK5] Assessment of ability to solve problems that arise in practice		
Subject contents	Theoretical introduction to molecular spectroscopy (rotational, vibrational and electronic levels, the Raman effect, Franck-Condon rule, Jabłoński diagram, fluorescence and phosphorescence, quenching of excited states). Theoretical introduction to solid state spectroscopy (band structure, trap states, recombination, luminescence centres, kinetics of luminescence, photoconduction, quantum dots). Types of photovoltaic cells and phenomena occurred in them. Steady state absorption and emission. Spectral lines. Sources of lights, filters, detectors. Lasers. Nonlinear optics and its application to laser spectroscopy. Time-resolved absorption and emission. Examples of experimental results recorded for different photovoltaic structures. Other methods of optical spectroscopy.						
Prerequisites and co-requisites							
Assessment methods and criteria	Subject passing criteria	Passing threshold			Percentage of the final grade		
	Written test	50.0%			100.0%		

Recommended reading	Basic literature	<p>1. Z. Kęcki „Podstawy spektroskopii molekularnej”</p> <p>2. J. Sadlej „Spektroskopia molekularna”</p> <p>3. M. Drozdowski (red.) „Spektroskopia ciała stałego”</p> <p>4. H. Abramczyk „Wstęp do spektroskopii laserowej”</p> <p>5. W. Demtröder „Spektroskopia laserowa”</p>
	Supplementary literature	All textbooks in laser spectroscopy
	eResources addresses	<p>Adresy na platformie eNauczenie:</p> <p>Spektroskopia optyczna w fotowoltaice - rok 2023/2024 - Moodle ID: 37848</p> <p>https://enauczanie.pg.edu.pl/moodle/course/view.php?id=37848</p>
Example issues/ example questions/ tasks being completed	<p>1. Jabłoński diagram</p> <p>2. Photoconductivity</p> <p>3. Absorption and emission spectra</p> <p>4. Methods of laser spectroscopy</p>	
Work placement	Not applicable	