



Subject card

Subject name and code	Contemporary applications of spectroscopic techniques, PG_00040974						
Field of study	Biomedical Engineering, Biomedical Engineering, Biomedical Engineering						
Date of commencement of studies	February 2025	Academic year of realisation of subject				2025/2026	
Education level	second-cycle studies	Subject group				Optional 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	2	Language of instruction				Polish	
Semester of study	3	ECTS credits				1.0	
Learning profile	general academic profile	Assessment form				assessment	
Conducting unit	Institute of Physics and Applied Computer Science -> Faculty of Applied Physics and Mathematics						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Marcin Dampc				
	Teachers						
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	Main goal of the lecture is to present state-of-the-art, widely used spectroscopy techniques. It is crucial to understand the physical processes involved, technique strong points and practical applications in science, medicine, engineering.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K7_U53] can apply advanced equipment used in biomedical diagnostics		Possess knowledge on specific spektrometry techniques used in diagnostics and research.		[SU3] Assessment of ability to use knowledge gained from the subject		
	[K7_W10] knows and understands, to an increased extent, the basic processes occurring in the life cycle of equipment, objects and technical systems, as well as methods of supporting processes and functions, specific to the field of study		Possess knowledge on specific spektrometry techniques used in diagnostics and research.		[SW1] Assessment of factual knowledge		
	[K7_U12] is able, to an increased extent, to analyze the operation of components and systems related to the field of study, as well as to measure their parameters and study their technical characteristics, and to plan and carry out experiments related to the field of study, including computer simulations, interpret the obtained results and draw conclusions		Possess knowledge on the technical parameters of spektrometers and can select spectrometer to a specific phenomenon/process investigated.		[SU3] Assessment of ability to use knowledge gained from the subject		

Subject contents	<p>1. Introduction to molecular physics: rotational excitation of molecules, vibrational excitation of molecules, electronic excitation of atoms and molecules, rotational spectra, spectra of vibrational excitation during the electronic transition, ionization.</p> <p>2. Molecular processes control by electron beam: introduction to electron spectroscopy, cross sections, excitations, resonant electron attachment, examples.</p> <p>3. Molecular clusters: generation of cluster beams, vibrational spectroscopy of clusters, negative ion clusters, superfluid helium droplets as environment for cluster spectroscopy and cold chemistry.</p> <p>4. Femtosecond spectroscopy: introduction to technique, femtosecond photoelectron spectroscopy, dynamics of non-adiabatic processes, femtosecond coincidence spectroscopy, femtosecond spectroscopy of anions - relaxation processes, metallic clusters, desorption, modern lasers.</p>		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Lecture	50.0%	100.0%
Recommended reading	Basic literature	<p>Z. Kęcki, Podstawy spektroskopii molekularnej, Wydawnictwo Naukowe PWN, Warszawa 1992.</p> <p>H. Haken, H. C. Wolf, Fizyka molekularna z elementami chemii kwantowej, Wydawnictwo Naukowe PWN, Warszawa 1998.</p> <p>H. Haken, H. C. Wolf, Atomy i kwanty, Wydawnictwo Naukowe PWN, Warszawa 2002.</p> <p>C. N. Banwell, Fundamentals of molecular spectroscopy, McGraw-Hill, London 1983.</p>	
	Supplementary literature	C. Kittel Wstęp do fizyki ciała stałego, Wydawnictwo Naukowe PWN, Warszawa 1999.	
	eResources addresses	Adresy na platformie eNauczenie:	
Example issues/ example questions/ tasks being completed	<p>1. Dissociative electron attachment for selective bond breaking.</p> <p>2. Cold chemistry - creation of molecules under cold, space conditions and reproduction of this environment in laboratory conditions.</p> <p>3. Dynamics of molecular processes in biocomplexes with abundant water.</p>		
Work placement	Not applicable		

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