



Subject card

Subject name and code	Spectroscopic Methods for Bionanomaterials Research, PG_00069343						
Field of study	Nanotechnology						
Date of commencement of studies	October 2025	Academic year of realisation of subject				2026/2027	
Education level	first-cycle studies	Subject group					
Mode of study	Full-time studies	Mode of delivery				at the university	
Year of study	2	Language of instruction				Polish	
Semester of study	4	ECTS credits				1.0	
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		dr hab. inż. Agnieszka Witkowska				
	Teachers		dr hab. inż. Agnieszka Witkowska				
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	0.0	0.0	15.0	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		1.0		9.0	25
Subject objectives	The aim of the course is to introduce students to the practical aspects of molecular spectroscopy, familiarize them with the principles of preparing and conducting a spectroscopic experiment and with methods of interpreting spectra, with particular emphasis on the possibility of using spectroscopic techniques in biomaterials research.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_U04] can plan and conduct experiments, critically analyze their results, draw conclusions and formulate opinions. Has laboratory experience.		The student is able to prepare and conduct a spectroscopic experiment and has the ability to properly analyze spectra and interpret the obtained results.		[SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task		
	[K6_U02] can analyze and solve simple scientific and technical problems based on possessed knowledge, applying analytical, numerical, simulation and experimental methods.		The student is able to solve a simple scientific problem related to the determination of structural parameters of materials and nanostructured systems using molecular spectroscopy methods.		[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment		
	[K6_W09] Has knowledge of the structure and operation of scientific instruments, measuring and test equipment and in the field of planning and conducting a physical experiment and critical analysis of its results.		Students gain the knowledge of the construction and operation of spectroscopic devices. They understand how to plan and conduct appropriate spectroscopic experiment, as well as how to analyze spectra and interpret the results obtained using this research method.		[SW1] Assessment of factual knowledge		

Subject contents	<p>Course content – laboratory</p> <p>1. FTIR Spectroscopy: Introduction to the construction and operating principles of a FTIR spectrometer; sample preparation; recording and analyzing spectra to investigate, for example, samples of natural and synthetic bone, drugs, or for the identification of organic compounds; preparation of a report.</p> <p>2. UVVis spectroscopy: Introduction to the construction and operating principles of a UVVis spectrometer; preparation of samples and measurement of spectra, e.g., nanoparticles obtained by biosynthesis, functionalized nanoparticles and nanostructures used for the detection of antibodies or selected organic compounds, as well as titanium dioxide for determination of its band gap energy; analysis of the obtained spectra; preparation of a report.</p> <p>3. X-ray photoelectron spectroscopy (XPS): Introduction to the construction and operating principles of an XPS spectrometer; preparation of samples and measurement of spectra, e.g., bioactive glasses doped with Ag, Nb, or Sr, or calcium-phosphate biocomposites reinforced with carbon nanotubes; analysis of the obtained spectra; preparation of a report.</p>		
Prerequisites and co-requisites	Knowledge of basics of materials engineering, materials physics and modern physic		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Completion of assigned laboratory exercises and submission of prepared reports	100.0%	100.0%
Recommended reading	Basic literature	<p>[1] J.Sadlej, Spektroskopia molekularna, WNT, Warszawa</p> <p>[2] Z.Kęcki, "Podstawy spektroskopii molekularnej", PWN, Warszawa</p>	
	Supplementary literature	<p>[1] J.M.Hollas, Modern Spectroscopy, John Wiley & Sons, Ltd.</p> <p>[2] P. Atkins, J.de Paula, Chemia fizyczna, Rozdz.16 Spektroskopia 1: widma rotacyjne i oscylacyjne; Rozdz. 17 Spektroskopia 2: przejścia elektronowe, PWN</p>	
	eResources addresses		
Example issues/ example questions/ tasks being completed	<p>Comparative analysis of FTIR spectra of natural and synthetic bone samples.</p> <p>Analysis of antibiotics in water samples using IR spectroscopy.</p> <p>Determination of the size of nanoparticles obtained during the biosynthesis process using UV-Vis spectroscopy.</p>		
Practical activities within the subject	Not applicable		

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