



Subject card

Subject name and code	, PG_00053321						
Field of study	Biomedical Engineering, Biomedical Engineering, Biomedical Engineering						
Date of commencement of studies	October 2022	Academic year of realisation of subject			2022/2023		
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	2	ECTS credits			3.0		
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 Małgorzata Franz				
	Teachers		dr hab. Jan Franz				
Lesson type and method of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	0.0	0.0	0.0	45
	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	45		5.0		25.0	75
Subject objectives	The aim of the course is to familiarize the student with selected issues of molecular physics.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
Subject contents	1. Introduction to the lecture: photons and waves, atomic structure. 2. Fundamentals of quantum mechanics: wave-particle duality, wave function, Schrödinger equation, Heisenberg uncertainty principle, free particle motion, particle in a square-well, tunnelling phenomenon, hydrogen atom, atomic orbital, hydrogen ion. 3. Electric and magnetic properties of molecules. 4. Molecular solid: types of crystal bonds and their characteristics. 5. Interaction of electromagnetic radiation with particles: forms of particle energy, quantization of energy, energy distribution in the state of thermal equilibrium, probability of absorption and emission of radiation, types of spectroscopy. 6. The rotational energy of molecules. 7. The vibrational energy of molecules. 8. The interaction of electromagnetic radiation with vibrating molecules: Raman spectrum. 9. Molecular electronic transitions: electronic states and the energy of electronic states.						
Prerequisites and co-requisites							
Assessment methods and criteria	Subject passing criteria		Passing threshold		Percentage of the final grade		
	presentation		50.0%		20.0%		
	passing the lecture		50.0%		80.0%		
Recommended reading	Basic literature		Z. Kęcki, "Podstawy spektroskopii molekularnej", Wydawnictwo Naukowe PWN, Warszawa 2013.				
			P. Atkins, J. de Paula, "Chemia fizyczna", Wydawnictwo Naukowe PWN, Warszawa 2016.				
			H. Haken, H. Ch. Wolf, Fizyka molekularna z elementami chemii kwantowej, Wydawnictwo Naukowe PWN Warszawa 1998.				
	Supplementary literature		G. Ślósarek, Biofizyka molekularna, Wydawnictwo Naukowe PWN Warszawa 2011.				
	eResources addresses						

Example issues/ example questions/ tasks being completed	The examples of exam questions: Represent and describe the forms of internal energy of molecules. Represent and describe the physical quantities which characterizing the magnetic properties of molecules.
Work placement	Not applicable