GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Molecular physics, PG_00064443		
Field of study	Biomedical Engineering, Biomedical Engineering, Biomedical Engineering		
Date of commencement of studies	February 2025	Academic year of realisation of subject	2024/2025
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	1	Language of instruction	Polish
Semester of study	1	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 hab. Jan Franz	
	Teachers	dr hab. Jan Franz	

Lesson types and methods 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
[K7_W02] knows and understands, to an increased extent, selected laws of physics and physical phenomena, as well as methods and theories explaining the complex relationships between them, constituting advanced general knowledge in the field of technical sciences related to the field of study	The student knows and understands the basics of molecular physics.	[SW1] Assessment of factual knowledge
[K7_U02] can perform tasks related to the field of study as well as formulate and solve problems applying recent knowledge of physics and other areas of science	The student is able to use the acquired knowledge in the applications of molecular spectroscopy.	[SU3] Assessment of ability to use knowledge gained from the subject
[K7_K01] is ready to create and develop models of proper behaviour in the work and life environment; undertake initiatives; critically evaluate actions of their own, teams and organisations they are part of; lead a group and take responsibility for its actions; responsibly perform professional roles taking into account changing social needs, including: - developing the achievements of the profession, - observing and developing rules of professional ethics and acting to comply to these rules	The student is able to prepare a presentation on molecular physics in relation to modern trends in biomedical engineering.	[SK4] Assessment of communication skills, including language correctness

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 G. Ślósarek, Biofizyka molekularna, Wydawnictwo Naukowe PWN Warszawa 2011. H. Haken, H. Ch. Wolf, Fizyka molekularna z elementami chemii kwantowej, Wydawnictwo Naukowe PWN Warszawa 1998.
	Supplementary literature	P. W. Atkins, R. S. Friedman, "Molecular quantum mechanics", Oxford University Press, 1997.
	eResources addresses	Adresy na platformie eNauczanie:
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	

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