GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Atomic and molecular physics II, PG_00039517		
Field of study	Technical Physics		
Date of commencement of studies	February 2024	Academic year of realisation of subject	2024/2025
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	4.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Zakład Fizyki Zderzeń Elektronowych -> Instytut Fizyki i Informatyki Stosowanej -> Faculty of Applied Physics and Mathematics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Paweł Możejko	
	Teachers	dr hab. Jan Franz prof. dr hab. Julien Guthmuller dr hab. Paweł Możejko	

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	15.0	60
	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	60	8.0	32.0	100

Subject objectives

Presentation of selected topics related to the theoretical description of the structure of multi-electron atoms and molecules (lecture, exercises).

Presentation of selected computational methods of the atomic and molecular physics (lecture, exercises).

Presentation of selected topics in atomic and molecular physics (seminars).

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_K03] Can cooperate and work in a group, performing different functions. Can make self-assessment, as well as constructively assess the effects of other persons' work.	The student is able to prepare and conduct a seminar presentation. Can take part in a discussion of another person's seminar presentation.	[SK1] Assessment of group work skills [SK4] Assessment of communication skills, including language correctness
[K7_W02] Has enhanced, theoretically-founded, detailed knowledge of selected field of physics, and sufficient knowledge of related fields of science or technology.	The student knows the basics of the theoretical description of the structure of multi-electron atoms and molecules.	[SW1] Assessment of factual knowledge

Subject contents	Lectures and exercises: 1) Approximative methods of solving the Schroedinger equation - variation principle 2) The ground state of the helium atom 3) The Ritz method 4) Multi-electron systems - Hartree-Fock equations 5) Hydrogen-like ion and hydrogen molecule 6) Born-Oppenheimer approximation 7) Electronic structure of molecules 8) Oscillatory structure of molecules 9) Rotational structure of molecules 10) Basic methods of quantum chemistry ((multi-configuration methods, DFT) Seminars: topics related to modern experimental methods used in the study of atoms and molecules.
Prerequisites and co-requisites	Knowledge of elementary quantum mechanics.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Writing exam	50.0%	50.0%
Seminar	50.0%	50.0%

Recommended reading	Basic literature	Pauling, L: Introduction to Quantum Mechanics: With Applications to Chemistry (Dover) L. Piela "Idee Chemii Kwantowej" PWN Demtroder Wolfgang "Atoms, Molecules and Photons" Springer 2018
	Supplementary literature	S. Kryszewski "Mechanika kwantowa" Wyd. UG
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	How to describe the electronic structure of the hydrogen-like ion? How to calculate the ground state of the hydrogen molecule? Please explain the Born-Oppenheimer approximation using the example of a diatomic molecule. What is the DFT method?	
Work placement	Not applicable	