

Subject card

Subject name and code	Modern Physics, PG_00182158						
Field of study	Medical Physics						
Date of commencement of studies	October 2025		Academic year of realisation of subject			2026/2027	
Education level	Bachelor's studies		Subject group			Obligatory subject group in the field of study 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	4		ECTS credits			3.0	
Learning profile	academic		Assessment form			exam	
Conducting unit	Faculty of Mathematics, Physics and Informatics -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. Piotr Bojarski				
	Teachers						
Lesson types	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		0.0		45.0	90
Subject objectives	The aim of the course is to introduce students to the field of modern physics, covering key theories and phenomena developed in the 20th and 21st centuries. The classes present physics as a fundamental science that drives the development of other natural sciences including medicine, chemistry, and biology and emphasize its importance for understanding and improving technologies used in clinical practice. Students gain knowledge of the most important phenomena and theories of modern physics and explore their practical applications in diagnostics, therapy, and advanced technologies. The course develops the ability to interpret physical processes underlying medical innovations and fosters competences in linking theoretical knowledge with practical applications.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[FIZMEDL3_U01] He can formulate, analyse, and solve complex problems in physics and medicine, using mathematical formalism, based on the physical phenomena, principles, and theories he has learned.	The student is able, on the basis of the laws and theories of modern physics, to formulate, analyze, and solve problems in the field of physics and its applications in medicine. The student can use mathematical formalism to describe physical processes and theoretical concepts such as wave-particle duality, quantum mechanics, atomic structure, and the structure of solids. They are able to apply established physical models, use equations and computational methods to interpret phenomena and predict experimental outcomes. The student understands the limitations of models and can critically analyze results, comparing them with literature data or experimental findings. They are also able to identify the links between theory and the practical application of physical processes in diagnostics and therapy, which prepares them to apply physical knowledge to solving problems encountered in the medical environment.	[SU3] text preparation/written work
	[FIZMEDL3_W01] Knows and understands at an advanced level the phenomena, principles, laws and theories specific to physics and biophysics.	The student knows: physical theories developed in the 20th century and the experiments that verified them, -fundamental formulas in atomic, molecular, and nuclear physics, the structure of matter, theories of elementary particles, the problem of wave-particle duality, -the fundamentals of quantum mechanics necessary to understand the principles of radiodiagnostic equipment and the interaction of radiation with matter.	[SW4] test/exam - oral or written

Subject contents	Course content		
	• thermal radiation, • blackbody radiation, • Bohrs model of the atom, • photoelectric effect, • Compton effect, • de Broglie waves and waveparticle duality, • diffraction and interference of photons and particles, • Heisenbergs uncertainty principle and the correspondence principle, • Schrödinger equation for one-dimensional problems (free particle, potential step, potential barrier, tunneling effect, α-decay, scanning tunneling microscope), • bound states of particles: particle in a one-dimensional potential well (finite and infinite), • energy levels of the quantum harmonic oscillator, • quantum model of the hydrogen atom, • FranckHertz experiment, • SternGerlach experiment, • Pauli exclusion principle, fermions and bosons, • atoms in an external magnetic field, • energy structure of solids, • spectroscopic analytical methods, • lasers and their applications in medicine, • nanotechnology.		
Prerequisites and co-requisites	Knowledge of classical mechanics, optics, electricity, and magnetism at the level of the first three semesters.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	not applicable	51.0%	65.0%
	not applicable	51.0%	35.0%
Recommended reading	Basic literature	not applicable	
	Supplementary literature	not applicable	

	eResources addresses	
Example issues/ example questions/ tasks being completed	not applicable	
Work placement	Not applicable	

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