Subject card

Subject name and code	Modern Physics, PG_00182158		
Field of study	Medical Physics		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2027/2028
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_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
	[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

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%	35.0%
not applicable	51.0%	65.0%

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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