



Subject card

Subject name and code	, PG_00058941						
Field of study	Nanotechnology						
Date of commencement of studies	October 2022		Academic year of realisation of subject		2023/2024		
Education level	first-cycle 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	general academic profile		Assessment form		assessment		
Conducting unit	Instytut Nanotechnologii i Inżynierii Materiałowej -> Faculty of Applied Physics and Mathematics						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Beata Bochentyn				
	Teachers		dr hab. inż. Agnieszka Witkowska				
			dr hab. inż. Beata Bochentyn				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	15.0	15.0	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	Getting to know the basic laws of modern physics. Acquiring the ability to analyze physical phenomena and solve technical problems based on the laws of physics.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	K6_W01	The student uses his knowledge of modern physics to describe the world. He understands the physical foundations of quantum mechanics and can use them to describe the phenomenon of the microworld	[SW1] Assessment of factual knowledge
	K6_U04	The student is able to conduct experiments on his own laboratory. He can use the instruments available in the laboratory. The obtained results are presented in a report containing correctly formulated conclusions and assessment of measurement uncertainty.	[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment
	K6_U01	The student independently extends the knowledge obtained during the course based on the recommended textbooks and available sources, including the Internet. He can assess their substantive quality and skillfully uses them.	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information
	K6_W03	The student knows the basic branches of modern physics. He can describe groundbreaking experiments leading to the development of quantum physics. The student independently solves problems related to modern physics	[SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge
Subject contents	Speed of light, Michelson-Morley experiment, Special theory of relativityTime dilation and length contractionThe relativity of simultaneityLorentz transformationsThe twin paradox and other paradoxesRelativistic dynamics: mass, relativistic momentum and energyEquivalence of mass and energyRelativistic relationship between momentum and energyParticle creationBlackbody radiationThe photoelectric effectWaves and particles, atomic spectra, Pauli exclusion principleEarly models of the atom, Rutherford's experiment and the beginnings of nuclear physics, Bohr's atomWave equations for photons and electronsAngular momentum, electron spin, periodic tableStable and unstable nuclei, decay mechanism, nuclear fission, standard model.Synchrotron radiation		
Prerequisites and co-requisites	The course is dedicated to students who have previously successfully completed the general physics course (Physics I and Physics II)		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Laboratory	100.0%	30.0%
	Practical exercise	50.0%	30.0%
	Written exam	50.0%	40.0%
Recommended reading	Basic literature	1. D. Haliday, R. Resnick, J. Walker, Podstawy fizyki, Wyd. PWN 2. W.Moebis, S.J.Ling, J.Sanny, Fizyka dla szkół wyższych, Tom 3, OpenStax Polska https://cnx.org/contents/u2KTPvIK@8.12:gX9LxBpm@5/5-2-Wzgl%C4%99dno%C5%9B%C4%87-jednoczesno%C5%9Bci-zdarze%C5%84#0 3. J. Massalski, Fizyka dla inżynierów. Część II. Fizyka współczesna, Wyd. WNT P.A. Tipler, R.A. Llewellyn, Fizyka współczesna, Wyd. PWN	
	Supplementary literature	Ohanian, Hans C., and John T. Markert. Physics for Engineers and Scientists. Vol. 1. 3rd ed. New York, NY: Norton, 2007. ISBN: 9780393930030	
	eResources addresses	Adresy na platformie eNauczanie: Fizyka współczesna - laboratorium 2024 - Moodle ID: 18300 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=18300 Fizyka współczesna - laboratorium 2024 - Moodle ID: 18300 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=18300	

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