



Subject card

Subject name and code	, PG_00060375						
Field of study	Nanotechnology						
Date of commencement of studies	February 2023	Academic year of realisation of subject			2022/2023		
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	1	ECTS credits			2.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Zakład silnie skorelowanych układów elektronowych -> Instytut Nanotechnologii i Inżynierii Materiałowej -> Faculty of Applied Physics and Mathematics						
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Michał Winiarski					
	Teachers	dr inż. Michał Winiarski					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	0.0	0.0	30
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	30	0.0		0.0		30
Subject objectives	Acquiring knowledge on the interaction of ionizing radiation with materials						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	K7_W03	Student has a knowledge of atomic and subatomic scale structure of matter and understands its relevance to the interaction with ionizing radiation.			[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge		
	K7_W02	Student knows the effects of ionizing radiation on materials and devices, including nanodevices.			[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge		
Subject contents	1. Corpuscular - wave dualism; the Heisenberg uncertainty principle. 2. Models of the atom: the Bohr model; atomic spectra; the Schrödinger equation; potential barrier and tunneling effect; Schrödinger's equation for a hydrogen atom. 3. X-rays. 4. The energy of binding the atomic nucleus. Fundamental interactions. 5. Nuclear models: drip, Fermi gas, shell and collective. 6. Radioactive transformations of atomic nuclei. 7. Fission and fusion reactions and their products 8. The interaction of ionizing radiation with matter: photoelectric effect, Compton effect and creation electron-positron pairs. 9. Size and dosimetry units. 10. The effect of ionizing radiation on living matter, materials and devices. 11. Ionizing radiation detectors. 12. Sources of ionizing radiation in the environment.						
Prerequisites and co-requisites	The course is dedicated to students who have completed the experimental physics course.						
Assessment methods and criteria	Subject passing criteria	Passing threshold			Percentage of the final grade		
	Written test	50.0%			80.0%		
	Homeworks	50.0%			20.0%		

Recommended reading	Basic literature	1. <i>University physics, Vol. 3</i> . OpenStax, 2016. Available on-line free of charge: https://openstax.org/details/books/university-physics-volume-3 2. A. Kamal. <i>Nuclear Physics</i> . Berlin-Heidelberg: Springer-Verlag, 2014
	Supplementary literature	S.S.M. Wong. <i>Introductory Nuclear Physics</i> . Weinheim, Wiley-VCH, 2004
	eResources addresses	Adresy na platformie eNauczanie: Materiały a Promieniowanie Jonizujące - Moodle ID: 29144 https://enauczenie.pg.edu.pl/moodle/course/view.php?id=29144
Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> 1. Corpuscular - wave dualism; the Heisenberg uncertainty principle. 2. Models of the atom: the Bohr model; atomic spectra; the Schrödinger equation; potential barrier and tunneling effect; Schrödinger's equation for a hydrogen atom. 3. X-rays. 4. The energy of binding the atomic nucleus. 5. Nuclear models: drip, Fermi gas, shell and collective. 6. Radioactive transformations of atomic nuclei. 7. Fission and fusion reactions and their products 8. The interaction of ionizing radiation with matter: photoelectric effect, Compton effect and creation electron-positron pairs. 9. Size and dosimetry units. 10. The effect of ionizing radiation on living matter and the human body. 11. Ionizing radiation detectors. 12. Sources of ionizing radiation in the environment. 13. Selected physical methods of medical diagnosis. 	
Work placement	Not applicable	