



Subject card

Subject name and code	High Energy Physics with Elements of Nuclear Energy, PG_00068090								
Field of study	Biomedical Engineering								
Date of commencement of studies	October 2025	Academic year of realisation of subject		2027/2028					
Education level	first-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	3		Language of instruction		Polish				
Semester of study	5		ECTS credits		5.0				
Learning profile	general academic profile		Assessment form		exam				
Conducting unit	Division of Complex Systems Spectroscopy -> Institute of Physics and Applied Computer Science -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology								
Name and surname of lecturer (lecturers)	Subject supervisor		dr Brygida Mielewska						
	Teachers								
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM		
	Number of study hours	30.0	30.0	0.0	0.0	0.0	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		4.0		61.0	125		
Subject objectives	To acquaint students with the properties and structure of matter at the subatomic level and with the methods of accelerating of high energy beams in electric and magnetic fields. Discussion of energy release processes in nuclear reactions, applications of these processes in power engineering, medicine and safety.								
Learning outcomes	Course outcome		Subject outcome		Method of verification				
	[K6_K02] is ready to critically assess possessed knowledge and acknowledge the importance of knowledge in solving cognitive and practical problems		the student critically evaluates the knowledge he/she has acquired in the field of high energy use and discusses the challenges and obligations resulting from its use		[SK5] Assessment of ability to solve problems that arise in practice				
	[K6_U02] can perform tasks related to the field of study in an innovative way as well as solve complex and nontypical problems, applying knowledge of physics, in changing and not fully predictable conditions		The student is able to solve typical problems of nuclear physics		[SU3] Assessment of ability to use knowledge gained from the subject				
[K6_W02] knows and understands, to an advanced extent, selected laws of physics and physical phenomena as well as methods and theories explaining the complex relationships between them, constituting the basic general knowledge in the field of technical sciences related to the field of study		the student knows and understands issues related to the structure of the atomic nucleus, the generation and interaction of ionizing radiation with the medium		[SW1] Assessment of factual knowledge					

Subject contents	Course content – lecture Lecture 1. Atomic structure and description of particles 2. Properties and energetics of the atomic nucleus 3. Radioactivity and nuclear reactions 4. Types of radioactive decays 5. Transmutations 6. Generation and control of charged particle beams 7. Particle accelerators 7. Generation and applications of radioisotopes in medicine, science and industry 7. Interaction of radiation with matter 8. Radiation detectors 9. Nuclear energy Arithmetic exercises 1. Elements of relativistic mechanics and quantum mechanics (energy and momentum of particles, de Broglie waves, uncertainty principle, X-ray tube). 2. Interaction of radiation with matter (linear and mass coefficient, half-thickness, range of particles in a material, phenomena characteristic of gamma radiation - Compton's effect, photoelectric, pair formation). 3. Structure and properties of the atomic nucleus, binding energy per nucleon, energy of fusion or fission of nuclei. 4. Natural radioactivity (law of decay, activity, mean lifetime and half-life). 5. Nuclear reactions, conservation laws in reactions, cross section, reaction efficiency, activation of a sample in a neutron beam, fission of nuclei.				
Prerequisites and co-requisites	Mechanics, Electromagnetism, atomic physics				
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade		
	half-part exam theory and problems(2/2)	50.0%	50.0%		
Recommended reading	Basic literature	University Physics v. 3 Openstax			
	Supplementary literature	S. Tavernier, Experimental Techniques in Nuclear and Particle Physics, Springer Open Access book (2010)			
	eResources addresses				
Example issues/ example questions/ tasks being completed	1. Binding energy of the nucleus 2. Interaction of gamma radiation with matter 3. Cyclotron - construction and principle of operation				
Practical activities within the subject	Not applicable				

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