



Subject card

Subject name and code	Collision Spectroscopy, PG_00053323						
Field of study	Biomedical Engineering, Biomedical Engineering, Biomedical Engineering						
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			4.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Department of Physics of Electronic Phenomena -> Faculty of Applied Physics and Mathematics						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Ireneusz Linert				
	Teachers		dr inż. Ireneusz Linert				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	15.0	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		50.0	100
Subject objectives	Gaining knowledge and skills in the field of electron and ion collision spectroscopy and photoionization						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_K01] is ready to create and develop models of proper behaviour in the work and life environment; undertake initiatives; critically evaluate actions of their own, teams and organisations they are part of; lead a group and take responsibility for its actions; responsibly perform professional roles taking into account changing social needs, including: n - developing the achievements of the profession, n- observing and developing rules of professional ethics and acting to comply to these rules n	The student presents the results of the project.	[SK2] Assessment of progress of work
	[K7_U02] can perform tasks related to the field of study as well as formulate and solve problems applying recent knowledge of physics and other areas of science	The student learns the experimental methods of collision spectroscopy. Knowledge acquired can be applied to solving new problems.	[SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools
	[K7_U08] while identifying and formulating engineering tasks specifications and solving these tasks, can: n- apply analytical, simulation and experimental methods, n- notice their systemic and non-technical aspects, n- make a preliminary economic assessment of suggested solutions and engineering work n	The student is able to design spectrometric devices.	[SU1] Assessment of task fulfilment
[K7_W02] Knows and understands, to an increased extent, selected laws of physics and physical phenomena, as well as methods and theories explaining the complex relationships between them, constituting advanced general knowledge in the field of technical sciences related to the field of study	The student learns the laws and physical phenomena related to the interaction of charged particles (electrons, positrons, ions) and photons with matter.	[SW1] Assessment of factual knowledge	
Subject contents	1. Electron collision spectroscopy 1.1 Electronic collision processes 1.2 Cross section 1.3. Interaction potential 1.4. Electron beam sources 1.5. Positron beam sources 1.6 Electron selectors and spectrometers 1.7 Electron elastic collisions 1.8 Inelastic collisions of electrons 1.9 Collisions of positrons. 1.10 Ionization spectroscopy 1.11 Electron capture spectroscopy 2. Ion collision spectroscopy. 2.1 Ionic collision processes 2.2 Sources of ion beams 2.3 Methods of detection of atoms and ions 3. Photoelectron spectroscopy. 3.1. Fundamentals of photoelectron spectroscopy 3.2. Absorption and photoionization processes. 3.3. Synchrotron radiation 3.4. Construction of experimental setups 3.5. Photoelectron spectrometers		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	project	80.0%	20.0%
	laboratory	80.0%	30.0%
	lecture	50.0%	50.0%
Recommended reading	Basic literature	1. A. Oleś, Metody eksperymentalne fizyki ciała stałego: leptony i fotony. WNT 1993. 2. H. Massey, Atomic and molecular collisions.	
	Supplementary literature	E.W. McDaniel, Atomic Collisions.	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	Principle of operation and construction of an electron spectrometer, properties of electrostatic lenses, source positrons		
Work placement	Not applicable		