



Subject card

Subject name and code	Physical Methods in Biology and Medicine, PG_00047934						
Field of study	Biomedical Engineering						
Date of commencement of studies	October 2024	Academic year of realisation of subject			2026/2027		
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	6	ECTS credits			4.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Department of Atomic, Molecular and Optical Physics -> Faculty of Applied Physics and Mathematics						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Paweł Możejko					
	Teachers						
Lesson types and methods of instruction	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		4.0		51.0	100
Subject objectives	To provide basic and fundamental information about physical methods used in biology and medicine.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K6_U06] can analyse the operation of components, circuits and systems related to the field of study, measure their parameters and examine technical specifications	Knowledge of the physical basis of a number of medical imaging techniques including ultrasound imaging, NMR, PET, CTX, etc.			[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_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	- knowledge of the structure of living matter at the cellular level - knowledge of the structure of DNA and RNA acids, their functions and methods of their research - knowledge of the physical basis of a number of medical imaging techniques including ultrasound imaging, NMR, PET, etc. - the ability to prepare and deliver a scientific seminar - the ability to search and use the source literature including articles in professional journals			[SW1] Assessment of factual knowledge		

Subject contents	Lectures: 1.) Introduction - the macroscopic and microscopic diversity of living 2.) Molecular structure of the living organisms 3.) The structure of cells 4.) Bio-matter investigation methods at the cellular level 5.) Molecular structure of biological systems 6.) Investigation methods of single molecular systems 7.) Structure and functions of the DNA 8.) Structure and functions of the RNA 9.) Experimental methods for investigation of the DNA and RNA 10.) Interaction of DNA with the environment 11.) Ionizing radiation. Radiolysis of water 12.) Interaction of the ionizing radiation with biological systems 13.) Ionizing radiation in medical diagnosis 14.) Ionizing radiation in medical therapy 15.) Methods for producing radioisotopes for medical therapy 16.) Imaging in medicine - physical base 17.) Physical aspects of X-ray spectroscopy 18.) Medical applications of X-ray spectrometry 19.) The physical basis of computed tomography 20.) Mathematical basis of tomography imaging 21.) Radiosensitizers 22.) Basics of NMR 23.) Medical applications of NMR method 24.) Physical basis of PET 25.) Medical applications of PET method 26.) Physical foundations of ultrasound 27.) The use of ultrasound in medical diagnosis 28.) Fundamentals of lasers 29.) The characteristics of laser beam 30.) Medical applications of lasers exercises : 1.) Protein Structure 2.) Methods of protein modeling 3.) Methods for modeling the components of cells 4.) Application of the Doppler effect in medicine 5.) Chromatography and its medical and biological applications 6.) Microscopy 7.) Basics of Mass Spectrometry 8.) Applications of mass spectrometry 9.) Mathematical Foundations of computer tomography 10.) Electrocardiography (ECG) 11.) Electroencephalography (EEG) 12.) Fundamentals of cancer diagnosis 13.) Fundamentals of cancer radiotherapy 14.) Modern aspects of interactions with low energy charged particles with bio-matter 15.) Synchrotron radiation in medicine		
Prerequisites and co-requisites	Physics (obligatory lecture at the first year of study)		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Practical exercise	50.0%	50.0%
	Midterm colloquium	50.0%	50.0%
Recommended reading	Basic literature	Skrypt z materiałami do przedmiotu „Metody Fizyczne w Biologii i Medycynie” „Fizyczne metody badań w biologii, medycynie i ochronie środowiska” red. A.Z. Hryniewicz, E. Rokita, PWN Warszawa 1999 „Fizyczne metody diagnostyki medycznej i terapii” red. A.Z. Hryniewicz, E. Rokita, PWN Warszawa 1999	
	Supplementary literature	J.M. Berg, J.L. Tymoczko, L. Stryer „Biochemia” PWN Warszawa 2005	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		