GDAŃSK UNIVERSITY OF TECHNOLOGY

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

<table>
<tr><td>Subject contents</td><td>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</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Physics (obligatory lecture at the first year of study)</td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Practical exercise</td><td>50.0%</td><td>50.0%</td></tr>
<tr><td>Midterm colloquium</td><td>50.0%</td><td>50.0%</td></tr>
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<tr><td>Recommended reading</td><td>
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<tr><td>Basic literature</td><td>Skrypt z materiałami do przedmiotu „Metody Fizyczne w Biologii i Medycynie” „Fizyczne metody badań w biologii, medycynie i ochronie środowiska” red. A.Z. Hrynkiewicz, E. Rokita, PWN Warszawa 1999 „Fizyczne metody diagnostyki medycznej i terapii” red. A.Z. Hrynkiewicz, E. Rokita, PWN Warszawa 1999</td></tr>
<tr><td>Supplementary literature</td><td>J.M. Berg, J.L. Tymoczko, L. Stryer „Biochemia” PWN Warszawa 2005</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:</td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td></td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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