GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Introduction to Medical Physics, PG_00068291						
Field of study	Biomedical Engineering						
Date of commencement of studies	October 2025		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	2		Language of instruction	Polish			
Semester of study	4		ECTS credits	2.0			
Learning profile	general academic profile		Assessment form	assessment			
Conducting unit	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	15.0	15.0	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		2.0	18.0		50
Subject objectives	To acquaint students with the basic issues of medical physics, the role of the medical physicist in diagnostics and therapy, as well as in radiological protection. The subject aims to build solid theoretical and practical foundations necessary for further study and work in the field of medical physics.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W10] knows and understands, to an advanced extent, the parameters, functions, and methods of analysis, design, and optimization of electronic circuits and systems, the definitions of error and measurement uncertainty, measurement methods, including time, frequency, and phase measurements, the properties of converters, and methods of digital signal processing, as well as the basic processes occurring in the life cycle of technical devices, objects, and systems, and methods of supporting processes and functions, specific to the field of study	The student knows and understands the methods by which medical physicists support the process of radiotherapy planning and diagnostics and the protection of patients and staff.	[SW1] Assessment of factual knowledge
[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 simple calculation problems related to the role of physicists in medicine, in particular how medical physicists ensure the radiological safety of patients and staff.	[SU3] Assessment of ability to use knowledge gained from the subject [SU1] Assessment of task fulfilment
[K6_K01] is ready to cultivate and disseminate models of proper behaviour in and outside the work environment; make independent decisions; critically evaluate actions of their own, teams they lead and organisations they are part of; take responsibility for results of these actions; responsibly perform professional roles, including:n - observing rules of professional ethics and require it from others,n - care for the achievements and traditions of the professionn	The student is ready to disseminate knowledge about the role and responsibility of medical physicists in the context of new imaging and therapy technologies.	[SK5] Assessment of ability to solve problems that arise in practice

Subject contents

Course content – lecture
Lecture Program (14 h) Introduction to Medical Physics (2 h) Definition and Scope of Medical Physics The Role of a Medical Physicist in the Healthcare System Basic Units and Physical Quantities Used in Medicine Ionizing Radiation and Its Applications in Medicine (3 h) Types of Ionizing Radiation (X, γ, Particles) Radiation Sources in Diagnostics and Therapy Interaction of Radiation with Biological Matter Basics of Operation of X-Ray Tubes and Linear Accelerators Radiotherapy Physics and Treatment Techniques (3 h) Basics of Radiotherapy: Teleradiotherapy and Brachytherapy Dose Planning and Treatment Quality Control The Role of a Medical Physicist in Cancer Therapy Modern Technologies in Radiotherapy (IMRT, VMAT, Proton Therapy) Image Diagnostics and Nuclear Medicine (3 h) Imaging Methods: X-Ray, CT, MRI, Ultrasound Physical Basics Basics of Nuclear Medicine: Radioisotopes, PET, SPECT The Role of the Medical Physicist in Diagnostics and Equipment Quality Control Radiation Protection and Safety (3 h) Basics of Radiological Protection of Patients and Staff Norms, Regulations and Standards (e.g. PN-86/J-80001) Fixed and Movable Shields, Design and Measurement Principles Dose Monitoring and Personal Dosimetry

Problems Exercise Program (14 h)

Basics of calculations in medical physics Conversion of dose and activity units Calculations related to ionizing radiation (e.g. absorbed dose, dose rate) Calculations related to radiotherapy Calculation of therapeutic dose and dose distribution Modeling of radiation attenuation in tissues and shields Exercises in planning simple treatment regimens Analysis and processing of diagnostic data Interpretation of radiation measurement results in diagnostics Calculations related to radioisotope activity and half-life Radiation protection tasks Calculations of the radiation attenuation factor by various materials Examples of dosimetry and radiation exposure assessment Determination of shield thickness and their effectiveness

Prerequisites and co-requisites

Physics 1, Physic2, Biophysics

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
final test	50.0%	50.0%
written exam	50.0%	50.0%

Recommended reading

Basic literature	Herman Cember & Thomas Johnson, INTRODUCTION TO Health Physics 4th edition, The McGraw-Hill Companies, Inc.
Supplementary literature	IAEA resources
eResources addresses	

Example issues/ example questions/ tasks being completed	What types of interactions characterize the interaction of alpha, beta, gamma and neutron radiation with the medium? Calculate the thickness of a shield that reduces gamma radiation by a factor of 10 with a given attenuation coefficient
Practical activites within the subject	Not applicable

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