



## Subject card

Subject name and code	, PG_00047941						
Field of study	Biomedical Engineering						
Date of commencement of studies	October 2023	Academic year of realisation of subject			2025/2026		
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			3.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Physics of Electronic Phenomena -> Faculty of Applied Physics and Mathematics						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Grażyna Jarosz				
	Teachers						
Lesson types and methods of instruction	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		3.0		42.0	75
Subject objectives	To acquaint students with the physical foundations of generation and detection of electromagnetic radiation, the design and operation of sources and radiation detectors and their use in biomedical engineering						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[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		Student can discuss any issue related to matter of the subject		[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU5] Assessment of ability to present the results of task		
	[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		Student knows physical basics of the generation and recombination of e-m radiation, knows sources and detectors used in the microwaves, IR, VIS, UV and X ranges		[SW1] Assessment of factual knowledge		
Subject contents	Lecture 1. Properties and spectrum of electromagnetic radiation. 2. Visual and energetic photometry. 3. Bremsstrahlung and atomic radiation. 4. Thermal radiation. 5. Absorption and recombination in semiconductors. 6. Luminescence. 7. Photoelectric and thermoelectric effect. 8. Discharges in gases. 9. Incandescent lamps. 10. Discharge lamps. 11. Electroluminescent diodes. 12. Lasers. 13. Microwaves sources. 14. X-ray sources. 15. Detectors of electromagnetic radiation: classification and parameters. 16. Noises in detectors. 17. Photomultiplier. 18. Photoresistors, photodiodes. 19. Thermocouples. 20. Bolometers, pyroelectric sensors. Seminar 1. Effect of electromagnetic radiation on the human body. 2. Lasers 3. Synchrotron radiation. 4. Generation of microwaves. 5. An eye as a detector of electromagnetic radiation. 6. Scattering of light. 7. CCD detectors. 8. Photographic emulsion. 19. Pyrometers. 10. X-ray lamps.						
Prerequisites and co-requisites							

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Project	100.0%	30.0%
	Midterm colloquium	50.0%	70.0%
Recommended reading	Basic literature	<p>J. Godlewski, Generacja i detekcja promieniowania optycznego, PWN Warszawa 2002.</p> <p>Z. Bielecki, A. Rogalski, Detekcja sygnałów optycznych, WNT Warszawa 2001.</p> <p>G. H. Rieke, Detection of Light, Cambridge University Press.</p>	
	Supplementary literature	No requirements	
	eResources addresses	Adresy na platformie eNauczenie:	
Example issues/ example questions/ tasks being completed	<p>1. Basic processes in which electromagnetic radiation is generated</p> <p>2. Specify the types of noise in the detectors</p>		
Work placement	Not applicable		

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