GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Physical Optics, PG_00045769		
Field of study	Technical Physics		
Date of commencement of studies	February 2027	Academic year of realisation of subject	2026/2027
Education level	second-cycle studies	Subject group	Specialty 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	Division of Atomic Molecular and Optical Physics -> 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 Mykola Shopa	
	Teachers	dr Mykola Shopa	

Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	0.0	0.0	15.0	60
	E-learning hours included: 0.0						
	eNauczanie source address: https://enauczanie.pg.edu.pl/moodle/course/view.php?id=26559						

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	60	5.0	35.0	100
Subject objectives	Students learn about the most important aspects of physical optics, in particular contemporary directions of optical research.				

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_U09] communicates effectively on topics related to physics and related disciplines in academic and non-academic environments, organises and participates in substantive discussions, and promotes the pursuit of reliable knowledge.	The student is able to present advanced issues of physical optics (e.g. interference, diffraction, polarization, and nonlinear optics) and their scientific applications in a clear and accessible manner, both within and outside the academic environment, demonstrating the ability to conduct substantive discussions and critically evaluate sources of knowledge.	[SU5] Assessment of ability to present the results of task [SU3] Assessment of ability to use knowledge gained from the subject
	[K7_W02] possesses advanced, theoretically grounded knowledge in physics and, to an extent appropriate to professional needs, in related scientific or technical disciplines, including applied computer science, applied physics and photovoltaics.	The student possesses advanced knowledge of physical optics, including the mathematical description of the phenomena of interference, diffraction, polarization, dispersion, nonlinear optics, and also understands the theoretical basis of operation of advanced optical devices and their practical application in applied physics and photovoltaic technologies	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation
	[K7_U08] is capable of designing and constructing devices, measuring instruments and technical systems based on physical principles, using appropriately selected advanced methods, techniques, tools and materials.	The student can independently or in a team design, correctly assemble and adjust an advanced optical system or measuring device, selecting appropriate components (light sources, optical elements, detectors) and tools.	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information
	[K7_K01] demonstrates readiness for continuous professional development, including updating and critically evaluating knowledge in physics and related fields, and recognising its importance in solving practical and theoretical problems.	The student is prepared to critically evaluate and continuously update his/her knowledge in the field of physical optics, and understands the need to follow the latest scientific and engineering developments in order to solve advanced practical problems in photovoltaics and applied physics.	[SK3] Assessment of ability to organize work

Subject contents	Course content – lecture History of optics Electromagnetic spectrum and black body radiation Electromagnetic waves Light sources, lasers Polarization control Lights impulses Optical activity Maxwell equations Light interaction with matter Metamaterials Light scattering Nanoscale optical phenomena, surface plasmons Nonlinear optics Ultrafast optics --- Course content – exercises Calculation exercises in the following areas: - geometric optics - Fourier transform - electrodynamics (EM radiation) - light dispersion - light polarization - light propagation in optically anisotropic media --- Course content – seminar Seminars on selected optical topics. Sample seminar topics: - The Cherenkov Effect - Discovery, Theory, and Applications - G. Lippmann's Color Reproduction Method - Optical Metamaterials - Light Pressure - Discovery, Theory, and Applications
Prerequisites and co-requisites	
Assessment methods and criteria	see table below

Subject passing criteria	Passing threshold	Percentage of the final grade
lectures, exam	50.0%	50.0%
seminar	50.0%	25.0%
practice, test	50.0%	25.0%

Recommended reading	Basic literature	D. Meschede Optics, Light and Lasers, Wiley-VCH (2004) M. Born, E. Wolf Principles of Optics, Pergamon (1970+) A. Lipson, S, Lipson, H, Lipson, Optical Physics 4th Edition, Cambridge Univ. Press, 2010 E. Hecht Optics, Addison-Wesley (1974+) D. Griffiths "Introduction to Electrodynamics". (1999)
	Supplementary literature	G. Chartier Introduction to Optics, Springer (2005) M. Fox Optical properties of Solids, Oxford (2001)
	eResources addresses	
Example issues/ example questions/ tasks being completed	Derivation of the wave equation for EM waves, energy density, and energy flux. Solution of the problem of light scattering by spherical particles (Mie Theory) Derivation of physical conditions for metamaterials Anisotropic materials, anisotropic phenomena Wave polarization eigenstates in an anisotropic crystal Phase-matching type I and type II	
Practical activites within the subject	Not applicable	

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