



## Subject card

Subject name and code	Waves and optics, PG_00020718						
Field of study	Technical Physics						
Date of commencement of studies	October 2022	Academic year of realisation of subject			2023/2024		
Education level	first-cycle studies	Subject group			Obligatory subject group in the field of study 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	3	ECTS credits			5.0		
Learning profile	general academic profile	Assessment form			exam		
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. Jędrzej Szmytkowski					
	Teachers	dr hab. inż. Jędrzej Szmytkowski					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	30.0	0.0	0.0	0.0	60
	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	60	5.0		60.0		125
Subject objectives	Teach students and strengthen their knowledge about the nature of mechanical and electromagnetic waves, their generation, theoretical models and applications. Special attention is paid to optical waves and laws of optical geometry.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	K6_U01	Student knows how to use literature and databases in waves and optics			[SU2] Assessment of ability to analyse information		
	K6_W01	Student knows how to separate wave phenomena in daily life			[SW1] Assessment of factual knowledge		
	K6_W02	The knowledge allows to analyze problems concerning waves and optics in the real world			[SW1] Assessment of factual knowledge		
Subject contents	Oscillations of simple physical objects. Transverse and longitudinal oscillations of the system: mass-spring. Harmonic oscillator. Simple pendulum. Physical pendulum. Damped harmonic oscillator. Driven harmonic oscillator. Resonance. Electrical oscillations in RLC circuits. Superposition of perpendicular and parallel oscillations. Beats. Oscillations in two degrees of freedom. Waves. Wave equation. Propagation of wave in different environments (solid, liquid, gas). String equation. Reflection and transmission of wave. Impedance. Interference. Standing wave. Wave packets. Phase and group velocities. Dispersion relations. Fourier analysis. Elements of acoustics. Doppler effect. Electromagnetic waves and their spectrum. Maxwell equations. Wave equation for EM waves. Refractive index and its relation with frequency. Impedance of EM wave. Poynting vector. Polarization of waves. Brewster angle. Fresnel equations. Interference of EM waves. Diffraction. Diffraction grating. Geometrical optics: Fermat rule. Snellius rule. Total internal reflection. Mirrors. Prisms. Lenses. Optical devices. Elements of photometry.						
Prerequisites and co-requisites	Course credit "Mechanics and heat" (07053) and "Mathematical analysis" (07053)						
Assessment methods and criteria	Subject passing criteria	Passing threshold			Percentage of the final grade		
	Oral exam	35.0%			30.0%		
	Written exam	65.0%			30.0%		
	Midterm colloquium	45.0%			40.0%		
Recommended reading	Basic literature	1. Crawford F.C., Fale, PWN W-wa 1973 2. Jaworski B., Dietlaf A., Procesy falowe, optyka, fizyka atomowa i jądrowa, PWN W-wa 1974 3. Godlewski J., Generacja i detekcja promieniowania optycznego, PWN W-wa 1997					

	Supplementary literature	1. Szczeniowski Sz., Fizyka doświadczalna, cz. I i IV, PWN W-wa 1983
	eResources addresses	Adresy na platformie eNauczanie: Fale i optyka - Moodle ID: 33947 <a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=33947">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=33947</a>
Example issues/ example questions/ tasks being completed		1. Simple gravity pendulum  2. Harmonic oscylator  3. Fermat's principle
Work placement		Not applicable