



## Subject card

Subject name and code	Classical mechanics and optical geometry, PG_00069494						
Field of study	Mechanika klasyczna i optyka geometryczna						
Date of commencement of studies	October 2025		Academic year of realisation of subject		2025/2026		
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		assessment		
Conducting unit	Institute of Physics and Applied Computer Science -> Faculty of Applied Physics and Mathematics -> Wydział Politechniki Gdańskiej						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Ewa Erdmann				
	Teachers		dr inż. Ewa Erdmann				
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	0.0	30.0	60
	E-learning hours included: 0.0						
	eNauczanie source addresses: Moodle ID: 1523 Mechanika klasyczna i optyka geometryczna <a href="https://enauczanie.pg.edu.pl/2025/course/view.php?id=1523">https://enauczanie.pg.edu.pl/2025/course/view.php?id=1523</a>						
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	To familiarize students with the basics of classical mechanics and geometric optics.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_W03] demonstrates knowledge advanced computation techniques, supporting the work of a mathematician and understand their limitations.	The student knows and understands the concepts, theories and theorems related to the application of mathematics in particle mechanics, particle systems and optics.	[SW1] Ocena wiedzy faktograficznej
	[K7_U03] uses differential and integral calculus, elements of complex analysis, algebraic methods, applies them in typical practical	The student uses the acquired knowledge in solving calculation tasks concerning classical mechanics and geometrical optics	[SU3] Ocena umiejętności wykorzystania wiedzy uzyskanej w ramach przedmiotu
	[K7_K02] formulates questions to deepen own understanding of a given topic or find missing elements of reasoning, understands the need to clearly present selected achievements of higher mathematics to laymen.	The student is able to formulate precise questions and use appropriate sources of knowledge. He is able to prepare a presentation in Polish on the basic applications of mathematics in classical mechanics and optics	[SK4] Ocena umiejętności komunikacji, w tym poprawności językowej [SK3] Ocena umiejętności organizacji pracy
	[K7_U09] constructs mathematical models used in specific advanced applications of mathematics, can use stochastic processes as a tool for modeling phenomena and analyzing their evolution, constructs mathematical models used in specific advanced applications of mathematics, uses stochastic processes as a tool for modeling phenomena and analyzing their evolution, recognizes mathematical structures in physical theories	The student recognizes mathematical structures in calculation tasks concerning classical mechanics and geometrical optics	[SU5] Ocena umiejętności zaprezentowania wyników realizacji zadania
Subject contents	Classical Mechanics		
	<p>1. History and Division of Mechanics. Mathematical and Physical Models. Mechanics of a Material Point. Definition of a Material Point.</p> <p>2. Kinematics of a Material Point. Coordinate Systems.</p> <p>3. Complex Motion. Transformation of Velocity and Acceleration. Galilean Transformation.</p> <p>4. Dynamics of a Material Point. Principle of Inertia. Mass and Force. Newton's Equations.</p> <p>5. Principle of Conservation of Momentum. Principle of Conservation of Energy. Principle of Conservation of Angular Momentum.</p> <p>6. Force in Relative Motion. Mechanics of a System of Material Points. Newton's Equations. Principle of Equal Action and Reaction.</p> <p>7. D'Alembert's Principle. Configuration Space and Lagrange's Equations of the First Kind.</p> <p>8. Generalized Coordinates and Momentum. Lagrange's Equations of the Second Kind.</p> <p>9. Rigid Body Mechanics.</p> <p>10. Angular momentum and kinetic energy of a rigid body. Moment of inertia of a rigid body. Moment of inertia tensor</p> <p>Geometrical Optics</p> <p>1. The nature of light, models of light, reflection and refraction of light at the boundary of two media, the laws of reflection and refraction.</p> <p>2. Fermat's principle. Derivation of the law of reflection from Fermat's principle. Snell's law from Fermat's principle. Total internal reflection.</p> <p>3. Classification of mirrors into plane, concave, and convex. Plane mirror. Convex and concave mirrors. The mirror equation. Interpretation of focal length. Ray tracing for a concave mirror. Sign conventions.</p> <p>4. Introduction to wave optics. Polarization. Diffraction and interference phenomena. Diffraction grating</p>		
Assessment methods and criteria	Preparing and presenting a scientific presentation on a selected topic related to the subject. Discussing the presentation topic with the group.		
	Prerequisites and co-requisites		
Assessment methods and criteria	Completion of required subjects during studies.		
	Subject passing criteria	Passing threshold	Percentage of the final grade
	solving quizzes	0.0%	25.0%
	presenting a seminar	50.0%	25.0%
	test	50.0%	50.0%

Recommended reading	Basic literature	<b>Classical Mechanics</b>  W. Rubinowicz, W. Królikowski, Mechanika teoretyczna  D. Halliday, R. Resnick, J. Walker, Podstawy fizyki  <b>Optics</b>  Cz. Bobrowski, Fizyka  E. Hecht, Optyka
	Supplementary literature	J. Taylor, Mechanika klasyczna  M. Wichtowski, Optyka liniowa
	eResources addresses	
Example issues/ example questions/ tasks being completed	1. Derive the principle of conservation of energy of the point particle. Describe the conditions of its application. 2. Derive Lagrange's equations of the second kind from D'Alembert's principle.	
Practical activities within the subject	Not applicable	

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