



Subject card

Subject name and code	Physics I, PG_00072241						
Field of study	Mechanical Engineering						
Date of commencement of studies	October 2026		Academic year of realisation of subject		2026/2027		
Education level	first-cycle studies		Subject group		Obligatory subject group 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 Fluid-Flow Machinery -> Institute of Energy -> Faculty of Mechanical Engineering and Ship Technology -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Klaudia Wrzask				
	Teachers		dr inż. Joanna Sypniewska mgr inż. Balbina Makurat-Kasprolewicz dr inż. Klaudia Wrzask				
Lesson types	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						
	eNauczanie source addresses: Moodle ID: 7782 Fizyka I https://enauczanie.pg.edu.pl/2025/course/view.php?id=7782						
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 acquire fundamental knowledge of selected areas of classical physics and develop the ability to understand selected physical principles and laws qualitatively, as well as to analyse selected physical phenomena quantitatively. To develop the ability to solve basic numerical problems and interpret physical phenomena using mathematical methods.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_W01] possesses advanced knowledge of mathematics, physics, and mechanics, applied to the modeling, analysis, and description of phenomena and processes occurring in mechanical systems		The student knows and understands the fundamental laws and principles of classical physics and selected topics in modern physics, including their application to the modeling, analysis, and description of phenomena and processes occurring in mechanical systems.		[SW1] Assessment of factual knowledge		
	[K6_U06] uses mathematical and physical models to analyze processes and phenomena occurring in mechanical devices		The student is able to apply basic mathematical models and the laws of classical physics to the quantitative analysis of processes and phenomena occurring in mechanical systems and devices.		[SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject		

Subject contents	Course content – lecture		
	1. Introduction Physical quantities, vector analysis, the SI system and basic measurement units. 2. Dynamics Fundamental interactions, Newton's laws, equations and trajectories of motion, friction. Work done by constant and variable forces, power, energy, conservative forces and the work–energy theorem. 3. Conservation Laws Kinetic and potential energy, conservation of mechanical energy. Momentum, centre of mass, collisions and rocket motion. Rotational motion, angular momentum, moment of inertia, torque and rotational kinetic energy. 4. Oscillations and Mechanical Waves Simple harmonic motion, simple and physical pendulums, damped and forced oscillations, resonance. Transverse and longitudinal waves, interference, standing waves and the Doppler effect. 5. Electrostatics and Electric Current Electric field and potential, Gauss's law, interaction energy. Capacitance, capacitors and dielectrics. Electric current, Ohm's and Kirchhoff's laws, electrical energy and power. 6. Magnetic Field and Electromagnetic Induction Lorentz force, magnetic fields of conductors, Ampère's and Biot–Savart laws. Faraday's and Lenz's laws, self-induction and magnetic-field energy. 7. Gravitational Field Universal gravitation, gravitational field strength, potential and energy, satellite motion, Kepler's laws, and orbital and escape velocities. 8. Fluid Mechanics Hydrostatic pressure, Pascal's law and Archimedes' principle. Bernoulli's equation, liquid and gas flows, viscosity, Reynolds number and flow losses. 9. Fundamentals of Thermodynamics Internal energy, heat, the ideal gas and thermodynamic processes. The laws of thermodynamics, energy balance, entropy, and the Carnot cycle and its efficiency.		
	Course content – exercises		
	1. Physical Quantities and Vector Analysis Dimensional analysis, SI unit conversion, vector operations, resolution into components, scalar and vector products, and force analysis. 2. Dynamics of a Particle Determination of forces, application of Newton's laws, analysis of rectilinear and curvilinear motion, friction, work, energy and power. 3. Conservation Laws Application of conservation of mechanical energy, analysis of collisions, momentum and centre-of-mass calculations. Angular momentum, rotational motion, moment of inertia and rotational kinetic energy. 4. Oscillations and Mechanical Waves Analysis of harmonic, damped and forced oscillations and resonance. Determination of period, frequency and energy. Analysis of waves, interference, standing waves and the Doppler effect. 5. Electrostatics and Electric Current Calculation of electric field strength, potential and interaction energy. Application of Coulomb's and Gauss's laws. Equivalent capacitance, DC circuits, Ohm's and Kirchhoff's laws, electrical energy and power. 6. Magnetic Field and Electromagnetic Induction Lorentz force, motion of a charge in a magnetic field, fields of conductors, Ampère's and Biot–Savart laws. Electromagnetic induction, electromotive force, self-induction and field energy. 7. Gravitational Field Application of universal gravitation, calculation of gravitational field strength, potential and energy, analysis of satellite motion, Kepler's laws, and orbital and escape velocities. 8. Fluid Mechanics Hydrostatic pressure, Pascal's law, Archimedes' principle and Bernoulli's equation. Analysis of liquid and gas flows, viscosity, Reynolds number and flow losses. 9. Fundamentals of Thermodynamics Analysis of ideal-gas states and processes, calculation of work and heat, application of the first and second laws, energy balance, Carnot-cycle efficiency and entropy changes.		
Prerequisites and co-requisites	Basic knowledge of mathematics and physics at secondary-school level.		
	Ability to perform basic algebraic transformations and use SI units.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
		80.0%	10.0%
		60.0%	50.0%
		50.0%	40.0%
Recommended reading	Basic literature	Physics of University Volume 1 OpenStax	
		Physics of University Volume 2 OpenStax	
	Supplementary literature	Halliday D., Resnick R., Walker J., <i>Podstawy fizyki</i> , t. 1–2, Wydawnictwo Naukowe PWN, Warszawa.	

	eResources addresses	Basic https://openstax.pl/szczegoly-ksiazki?book=Fizyka_dla_szk%C3%B3%C5%82_wy%C5%BCszych_tom_1 - https://openstax.pl/szczegoly-ksiazki?book=Fizyka_dla_szk%C3%B3%C5%82_wy%C5%BCszych_tom_2 -
Example issues/ example questions/ tasks being completed	What is the minimum engine power required for a car with a mass of 1,200 kg to drive uphill on a 15% gradient at a speed of 90 km/h? Assume that 25% of the car's power is used to overcome resistance to motion. Describe an example of a system in which elastic potential energy is stored. Why is a fall from a height of 10 metres onto concrete much more dangerous than a fall into water? Why are gases easier to compress than liquids and solids?	
Practical activities within the subject	Not applicable	

Document generated electronically. Does not require a seal or signature.