GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Fundamentals of Physics, PG_00047550		
Field of study	Automatic Control, Cybernetics and Robotics		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2025/2026
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	1	Language of instruction	Polish
Semester of study	2	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Katedra Fizyki Atomowej i Luminescencji -> Faculty Of Applied Physics And Mathematics -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Patrycja Stefańska-Ptaszek	
	Teachers	dr hab. inż. Maciej Demianowicz dr inż. Patrycja Stefańska-Ptaszek dr hab. inż. Jan Kozicki	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	15.0	0.0	0.0	0.0	45

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	45	3.0	27.0	75

Subject objectives

Providing the student with the specialist knowledge concerning the basic rules of physics immediately relevant to the technical areas.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[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	As part of the course the student acquires knowledge about chosen physical laws, theories, measurement methods and is able to explain and describe them	[SW1] Assessment of factual knowledge
[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 is able to solve physical problems within the practice classes	[SU1] Assessment of task fulfilment

Subject contents

LECTURE

1. Kinematics and dynamics of a material point. Principle of conservation of energy. Principle of conservation of momentum and angular momentum. Basic properties of gravitational field. Elements of mechanics of fluids.

2. Heat, work, internal energy, gas transformations. Elements of kinetic theory of gases. Entropy, reversible and non-reversible processes. Laws of thermodynamics.

3. Harmonic oscillator, addition of oscillations. Elastic waves. Basic properties of acoustic waves. Energy density and intensity of wave. Parameters of the medium, wave impedance.

4. Elements of geometrical optics. Wave optics: dispersion, interference, diffraction, and polarization of waves. Basics of lasers. Sources of light.

5. Einstein's postulates. Lorentz's transformation and its consequences. Relativistic optics.

6. Structure of atomic nucleus. Nuclear forces. Radioactivity.

7. Wave-particle duality. Wave function. The Heisenberg uncertainty relations. Schrödinger’s equation.

PRACTICE

1. Problems on kinematics of progressive motion, description of the motion in Cartesian system. Velocity, acceleration, normal and tangential acceleration. Problems on kinematics of rotational motion, description of the motion in Cartesian system and in a polar coordinate system. Problems on dynamics of progressive motion, applications of Newton's laws. Dynamics laws in non-inertial frame of reference. Problems on conservation of energy, momentum and angular momentum.

2. Problems related to the first law of thermodynamics in the case of an ideal gas. Problems related to Maxwell distribution. Calculation of entropy changes in reversible transformations of an ideal gas.

3. Examples of harmonic motion. Basics of wave motion. Wave energy density, Poynting’s vector, wave intensity.

4. Problems related to the interference of light. Diffraction and polarization of light. Fraunhofer single slit diffraction. Malus's law.

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Solving of the problems	50.0%	33.0%
Knowledge of the lecture material	50.0%	67.0%

Recommended reading

Basic literature	1. Halliday D., Resnick R., Walker J., Fundamentals of Physics 2. Collection of physics problems available at the website: www.mif.pg.gda.pl/zz/
Supplementary literature	1. University Physics, https://openstax.pl/en/
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	Conservation of energy, momentum, and angular momentum in the system of particles. Simple harmonic motion. Energy density of the longitudinal wave. Universal law of radioactive decay.
Work placement	Not applicable

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