GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Elements of modern physics, PG_00061199		
Field of study	Elementy fizyki współczesnej		
Date of commencement of studies	October 2024	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	3	Language of instruction	Polish
Semester of study	5	ECTS credits	5.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Division of Automation and Marine Energy -> Institute of Naval Architecture -> Faculty of Mechanical Engineering and Ship Technology -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Małgorzata Śmiałek-Telega	
	Teachers		

Lesson types

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

The aim of the course is to acquaint students with the fundamental phenomena and laws of physics related to oscillations, mechanical and electromagnetic waves, optics, electrical conduction, as well as selected topics in atomic physics, nuclear physics and quantum mechanics. The course is intended to develop skills in analytical and cause-and-effect reasoning, modelling of physical phenomena, and critical analysis of measurement results.

It provides the theoretical foundation for further specialised engineering and natural science courses, and it shapes the physical intuition necessary to understand the operation of technical devices and processes occurring in the environment. Students acquire a solid grounding in modern classical physics and an introduction to contemporary physics, which will enable them to make effective use of this knowledge in the course of their further studies and future professional work.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U01] is able to acquire information from specialized literary sources, databases and other resources, essential for solving engineering tasks; is able to compile the obtained information pieces and to interpret them, additionally is able to form conclusions and present justified opinion	The student is able to analyse and solve simple physics problems using appropriate models, mathematical methods and experimental data, and to interpret the obtained results in the context of the physical laws studied.	[SU1] Ocena realizacji zadania [SU3] Ocena umiejętności wykorzystania wiedzy uzyskanej w ramach przedmiotu [SU4] Ocena umiejętności korzystania z metod i narzędzi [SU5] Ocena umiejętności zaprezentowania wyników realizacji zadania
[K6_W02] possesses an organized knowledge on physics, including classic mechanics, acoustics, optics, electricity and magnetism, shows knowledge of the elements of quantum physics	The student knows and understands the fundamental laws and physical phenomena in the areas of oscillations, waves, electromagnetism, optics, atomic and nuclear physics, and quantum mechanics, and is able to explain their significance for phenomena occurring in nature and technology.	[SW1] Ocena wiedzy faktograficznej [SW3] Ocena wiedzy zawartej w opracowaniu tekstowym i projektowym

Subject contents	Course content – lecture 1. Oscillations 2. Mechanical waves (including acoustic waves) 3. RLC circuits 4. Electromagnetic waves 5. Geometrical optics 6. Interference and diffraction 7. Electrical conduction in solids 8. Elements of atomic physics 9. Elements of nuclear physics and nuclear energy 10. Radioactivity 11. Theory of relativity 12. Introduction to quantum mechanics
	Course content – exercises 1. Mechanical waves (including acoustic waves) 2. RLC circuits 3. Electrical conduction in solids 4. Elements of nuclear physics and nuclear energy 5. Radioactivity
	Course content – laboratory 1. Determination of the spring constant of springs and their combinations 2. Measurement of the speed of sound by the resonance method and by the superposition of mutually perpendicular vibrations 3. Study of longitudinal sound waves in rods 4. Determination of Youngs modulus by the beam deflection method 5. Investigation of the spectra of radiation from non-equilibrium gases 6. Determination of the sizes of slits and obstacles using laser light 7. Determination of the radius of curvature of a lens using Newtons rings

	8. Determination of the relative permittivity (dielectric constant) of solids 9. Measurement of electrical resistance using a Wheatstone bridge
Prerequisites and co-requisites	

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
laboratory	50.0%	30.0%
exercises	50.0%	30.0%
lecture	50.0%	40.0%

Recommended reading

Basic literature

1. David Halliday, Robert Resnick, Jearl Walker, Podstawy fizyki.
2. T. 1-5, Wydawnictwo Naukowe PWN, 2012 (a także każde inne wydanie)
3. J. Orear, Fizyka, tom 1 i 2, Warszawa 1998
4. A. Januszajtis, Fizyka dla Politechnik, tom 1-3, Warszawa 1991
5. J. Massalski, M. Massalska, Fizyka dla Inżynierów, tom 1 i 2, Warszawa 2013

Supplementary literature

1. Hermann Haken, Hans Christoph Wolf, Atomy i kwanty, PWN, 2012
2. Hugh D. Young, University Physics with Modern Physics, 15th Ed. Pearson, Addispn-Wesley, 2019
3. Paul A. Tipler, Ralph A. Llewellyn, Fizyka współczesna, Wydawnictwo Naukowe PWN, Warszawa 2012;
4. I.W. Sawieliew, Wykłady z fizyki, tom 1. i 2., Wydawnictwa Naukowe PWN, Warszawa, 2003

eResources addresses

Example issues/ example questions/ tasks being completed

1. Polarisation of an EM wave (linearly polarised and unpolarised waves, Maluss law)
2. Law of refraction of light (formula with description and diagram)
3. Concave spherical mirrors (diagram, ray diagram, and the types of images obtained depending on the position of the object relative to the mirror)
4. Diverging lens (diagram, ray diagram, and the types of images obtained depending on the position of the object relative to the lens)
5. Constructive interference (under what conditions it occurs, diagram with description)
6. Youngs double-slit experiment (diagram with description, when bright and dark fringes occur, formula)

Practical activites within the subject

Not applicable