University of Gdańsk

Subject card

Subject name and code	Physics, PG_00053437		
Field of study	Environmental Protection		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2024/2025
Education level	Bachelor's 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	academic	Assessment form	exam
Conducting unit			
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. Stanisław Pogorzelski	
	Teachers	prof. dr hab. Stanisław Pogorzelski	

Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	0.0	0.0	30
	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	30	5.0	65.0	100

Subject objectives	Familiarization with current achievements in the field of Environmental Physics, including indicators of the physico-chemical-thermal state of natural systems in order to monitor the time-seasonal-spatial evolution of environmental states using methods and theoretical considerations in the field of mechanics, thermodynamics, physics of wave motion, transport phenomena, and dosimetry of ionizing radiation.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[OŚL3_K05] Identifies the level of her/his knowledge and skills, demonstrates the need to update knowledge about the environment and its protection, demonstrates the need for continuous professional training and personal development.	The student has basic knowledge about the description of the state of the natural environment, methods and actions necessary to protect it.	[SK1] oral statement/conversation/ discussion [SK4] test/exam - oral or written
	[OŚL3_U11] Uses statistical methods as well as algorithms and IT techniques, including application software packages to describe environmental experiments and analysis of typical data in socio-economic activities based on science and natural sciences.	The student is able to use multi-parameter models of analysis of the evolution of environmental phenomena, including those in the field of machine learning and neural networks using Artificial Intelligence (AI) and research equipment application software.	[SU1] oral statement/conversation/ discussion [SU3] text preparation/written work [SU4] test/exam - oral or written
	[OŚL3_U04] Uses specialist language in the discussion and properly uses the nomenclature in the field of environmental protection and individual disciplines related to it.	The student is able to qualitatively and quantitatively (using appropriate mathematical formalisms, conservation principles) determine and define key parameters for describing the phenomena of environmental states	[SU1] oral statement/conversation/ discussion [SU3] text preparation/written work [SU4] test/exam - oral or written
	[OŚL3_W01] Discusses the basic concepts of mathematics, physics, chemistry and biology. Describes physical, chemical and biological phenomena occurring in nature as well as geological, geomorphological and climatic conditions of the functioning of nature.	The student is able to interpret the evolution of environmental phenomena based on advanced models in mathematics, physics, chemistry and biology, including advanced methods of statistical data analysis, taking into account geomorphological and climatic conditions.	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion [SW3] text preparation/written work
	[OŚL3_U09] Prepares in Polish/ English a short description of research, observation or problem task carried out during classes using appropriate scientific terminology.	The student has knowledge of planning and conducting an experiment on a model environmental system and analyzing the results based on the evolution of selected parameters.	[SU3] text preparation/written work [SU5] implementation of a problem task [SU6] demonstration of practical skills

Subject contents	I. Statics and kinematics of material points and continuous media 1. Physical quantities: scalars and vectors 2. Observation, experiment, measurement, error calculation 3. Newton's laws of dynamics 4. Principles of conservation of energy and momentum 5. Motion in a central force field, gravity 6. Rotational motion of a rigid body - law of rotational motion - Euler's r-no 7. Elastic properties of solids, Hooke's law, Young's modulus 8. Harmonic oscillator, damping, resonance 9. Mechanics of continuous media, fluid statics, continuity and Bernoulli's equation 10. Interaction in liquids, surface adsorption, capillarity II. Wave motion 1. Types of waves: mechanical, acoustic and electromagnetic waves 2. Wave phenomena: diffraction, refraction, interference, polarization 3. Wave equation, dispersion relation, group and phase velocity 4. Transport processes, Fick's laws, diffusion III. Electricity and magnetism 1. Electricity - statics: Charge, electric field, potential. Coulomb's and Gauss's laws 2. Electric current. Laws of current flow - Kirchhoff's laws. Circuits with current. Electric current in liquids - electrolysis. Electrochemistry. Galvanic cells, Nernst's law 3. Magnetic field, electromagnetic induction, magnetic properties of matter 4. Interaction of radiation with matter. Compton effect, radiation pressure - solar constant, photoelectric effect, photoelectric sensors in chemical analysis IV. Thermodynamics 1. Thermal and adiabatic interactions; heat, work and temperature 2. Zeroth law of thermodynamics - temperature and its measurement 3. Kinetic theory of gases, Clapeyron equation, real gas 4. Laws of thermodynamics, thermodynamic potentials, entropy 5. Phase changes, Clausius-Clapeyron equation, characteristic graph, 6. Thermodynamics of the atmosphere, heat balance of the Earth 7. Thermoelectric phenomena 8. Thermography, thermal analysis techniques in chemistry V. Elements of spectroscopy 1. Quantum properties of radiation, physics of thermal radiation Wien's formula, Stefan-Boltzmann's law 2. Energy spectra of emission and absorption of radiation 3. Types of spectroscopy 4. Spectroscopic apparatus 5. Absorption spectroscopy, Lambert-Beer law 6. Spectroscopic chemical analysis VI. Nuclear physics 1. Basic properties of nuclides: charge, mass, binding energy 2. Nuclear transformations 3. Laws of decay of nuclides: lifetime of nuclei, activity 4. Nuclear reactions 5. Nuclear technology, application of radioisotopes, radionuclides in the environment, radiation medicine 6. Isotope dating in chemical analysis
Prerequisites and co-requisites	Knowledge of the basics of Classical Physics, including mechanics, thermodynamics, wave physics, modern physics, nuclear physics. Additional requirements include knowledge of mathematical operatorics, mathematical analysis, statistics, and the basics of differential and integral calculus.
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
written exam	51.0%	100.0%

Recommended reading	Basic literature	1. A.K. Wróblewski, J.A. Zakrzewski; Wstęp do Fizyki, T1, T2 cz. 2, PWN, W-wa, 1991. 2. Sz. Szczeniowski; Fizyka Doświadczalna cz. I, II, PWN, 1980. 3. D. Halliday, R. Resnick; Fizyka, PWN, W-wa, 2003/2004. 4. B. Jaworski, A. Dietlaf T1, PWN, W-wa, 1981. 5. I.V. Sawieliew; Wykłady z fizyki T1, PWN, W-wa, 1987. 6. Cz. Bobrowski, Fizyka krótki kurs, WNT, W-wa, 2005. 7. W. Bolton, Zarys fizyki, PWN, W-wa, 1982. 8. F. Reif, Fizyka Statystyczna, PWN, W-wa, 1973. 9. K. Zalewski, Wykłady z termodynamiki fenomenologicznej i statystycznej, PWN, W- wa, 1969. 10. J. Orear, Fizyka, Tom 1, WNT, W-wa, 1993. 11. F.C. Crawford, Fale, PWN, W-wa, 1973. 12. C. Kittel, W.D. Knight, M.A., Ruderman, Mechanika, PWN, W-wa, 1973.
	Supplementary literature	1. B. Jaworski, A. Dietłaf, L. Miłkowska, Kurs Fizyki, T 2, Elektryczność i magnetyzm, PWN, W-wa, 1984. 2. R. Matusiak, Teoria pola elektromagnetycznego, WNT, W-wa, 1976. 3. E.M. Purcell, Elektryczność i magnetyzm, PWN, W-wa, 1974. 4. J. Ginter, Fizyka fal, część 1: Fale w ośrodkach jednorodnych, fale w ośrodkach niejednorodnych, część 2: Promieniowanie i dyfrakcja, stany związane, PWN, W-wa, 1993. 5. A. Cygański, Metody spektroskopowe w chemii analitycznej, Wyd. 2, WNT, W-wa,1997. 6. Z. Kęcki, Podstawy spektroskopii molekularnej, Wyd. 4, PWN, W-wa, 1998. 7. Z. Kąkol, Fizyka, Wydział Fizyki i Informatyki Stosowanej Akademii Górniczo Technicznej, Kraków, 2006-2015 (plik PDF).
	eResources addresses	
Example issues/ example questions/ tasks being completed	Statics and kinematics of phenomena in natural media. Wave propagation in water, Earth and atmosphere. Thermodynamics of the atmosphere. Phenomena of mass, energy and heat transport. Electromagnetic phenomena and radiation of bodies. Radioactive decays, radiation hazards in the natural environment, radioactive dating.	
Work placement	Not applicable	

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