



Subject card

Subject name and code	Physical basis of conversion and accumulation of energy, PG_00037297						
Field of study	Technical Physics						
Date of commencement of studies	October 2024	Academic year of realisation of subject			2025/2026		
Education level	first-cycle studies	Subject group			Optional 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	2	Language of instruction			Polish		
Semester of study	3	ECTS credits			1.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Physics of Electronic Phenomena -> Faculty of Applied Physics and Mathematics						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Piotr Grygiel				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	0.0	0.0	15
	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	15		2.0		8.0	25
Subject objectives	The knowledge of physical processes involved in conversion and accumulation of energy in the environment and technology.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K6_W02] has systematized knowledge of the basics of physics, including mechanics, thermodynamics, electricity and magnetism, optics, atomic and particle physics, solid-state physics, nuclear and elementary particle physics	Is able to formulate a qualitative and quantitative description of different processes of energy accumulation and conversion in the environment and technology.			[SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge		
	[K6_U08] can prepare written works and speeches in Polish and English, concerning detailed issues of physics and related fields, and scientific disciplines	Is able to prepare and perform a written elaboration concerning different processes of energy accumulation and conversion in the environment and technology.			[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information		
[K6_U02] analyzes and solves simple scientific and technical problems, based on possessed knowledge, using analytical, numerical, simulation and experimental methods	Is able to analyse a given problem and to obtain information from proper literature in order to prepare a written elaboration.			[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment			

Subject contents	<p>The Lecture:</p> <p>1. Energy and the principle of energy conservation (1h). 2. The phenomena of energy conversion in nature: solar energy and solar energy conversion on Earth, the energy balance on Earth, the formation of stars, stars energy sources, the structure of Sun and energetic processes on the Sun (3 h). 3. The phenomena of energy conversion in classical physics: conversion of mechanical and gravitational energy, conversion of chemical energy, conversion of electric energy (3 h). 4. Quantum and nuclear phenomena of energy conversion: the Seebeck, Peltier and Thomson effects, the electroluminescence, the thermoluminescence, nuclear explosions and controlled nuclear reactions (3h). 5. The physical mechanisms of energy transport: transport of heat, transport of electric energy, energy propagation through mechanical waves (3 h). 6. The energy storage: the storage of heat and sun energy, the accumulation of electric, mechanical, chemical and nuclear energy (2h).</p> <p>Problems to be written:</p> <p>1. Characters of the principle of energy conservation. The principle of conservation of mass - energy. 2. Energy sources and energy quality. 3. Energy sources of stars. 4. Sources of solar energy. 5. Forms of solar energy and their impact on processes taking place on Earth. 6. Devices converting mechanical energy into electricity. 7. Generation of X-rays. 8. Devices converting solar energy into thermal energy. 9. Devices converting solar energy into electricity. 10. Devices converting electricity into heat. 11. Seebeck effect and its use. 12. Peltier effect and its use. 13. Examples of combustion processes and their use in technology and energy. 14. Contemporary electrochemical cells. 15. Modern electric energy batteries. 16. Mechanical energy storage devices. 17. Factors causing storage and transport of energy. 18. Methods of energy transfer. 19. Modern electric light sources. 20. Chemical light sources. 21. Technical use of luminescence phenomena. 22. Inorganic light emitting diodes. 23. Organic light emitting diodes. 24. Nuclear reactions of synthesis and cleavage. 25. Energy aspects of a nuclear explosion. 26. Conversion of energy in hydroelectric and pumped storage power plants. 27. Conversion of energy in a wind power plant. 28. Conversion of energy in a thermal power plant. 29. Energy conversion at a nuclear power plant. 30. Energy conversion in a tidal power plant.</p>		
Prerequisites and co-requisites	1. Basic knowledge of mechanics and electricity. 2. Basic knowledge of nuclear and atomic physics (incl. quantum physics). 3. Basic knowledge of chemistry and thermodynamics. 4. Integral and differential calculus skills.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Written elaboration of the selected problem	50.0%	50.0%
	Credit for the course (written form)	50.0%	50.0%
Recommended reading	Basic literature	1. J. Mikielawicz, J.T. Cieśliński „Niekonwencjonalne urządzenia i systemy konwersji energii”, Maszyny Przepływowe pod red. E.S. Burki. Tom 24. IMP PAN, Ossolineum, Wrocław 1999.	
	Supplementary literature	1. F.J.Keller, W.E. Gettys, M.J. Skove „Physics”, McGraw-Hill Inc.,US; 2nd Revised edition, 1993.	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	<p>Describe the processes of energy conversion in a wind generator.</p> <p>Describe the process of energy accumulation in an acid battery.</p>		
Work placement	Not applicable		

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