GDAŃSK UNIVERSITY OF TECHNOLOGY

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 2026	Academic year of realisation of subject	2027/2028
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 -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Piotr Grygiel	
	Teachers		

Lesson types

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 phisical processes involved in conversion and accumulation of energy in the environment and technology.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U08] communicates effectively using specialist terminology in physics and related disciplines, enabling the preparation of reports, publications or presentations, as well as participation in discussion and expression of opinions.	Is able to produce a written report on the topics of energy conversion and energy storage in nature and technology, in Polish or English, using specialist terminology. Is able to present the results of the work in the form of an oral presentation and take part in the discussion that follows, expressing his/her own opinions.	[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_W02] possesses structured knowledge of the fundamentals of physics, including mechanics, thermodynamics, electricity and magnetism, optics, atomic and molecular physics, solid-state physics, and nuclear and particle physics.	Possesses a systematic understanding of the broadly defined physical principles and the mechanisms underlying various processes of energy conversion and storage in nature and technology, with a view to describing them in quantitative and qualitative terms.	[SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge
[K6_W06] has knowledge of technical sciences related to physics, including electronics or energy engineering, and understands their application in the design and implementation of technological processes.	Possesses knowledge of technical disciplines related to physics (e.g. electronics, power engineering, chemical engineering, materials engineering) and understand their application in the technological processes used in modern energy conversion and storage technologies.	[SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge

<table>
<tr><td>Subject contents</td><td>Course content – lecture

Lecture:

What is energy? Types of energy. Fundamental interactions in nature. The Sun as a perfect black body. The influence of the Earth's atmosphere on solar radiation. The source of solar energy. Types of state parameters. Entropy, reversible and irreversible processes. The laws of thermodynamics. Enthalpy. Thermodynamic potentials. Chemical potential. Thermodynamics of the Earth system. The concept of exergy, exergy of different energies. Exergy of a closed thermodynamic system. Exergy of enthalpy. Balance equations for control volume. Exergy of material flow (exergy of a stream). Exergy of radiation from a black body. Energy efficiency and exergy efficiency. Energy and exergy. Exergy balance. Conversion phenomena in classical physics: conversion of mechanical and gravitational energy, conversion of chemical and electrical energy. Seebeck, Peltier and Thomson phenomena. Thermal and solar energy storage. Accumulation of electrical, mechanical and chemical energy.

Examples of problems for written assignment

Forms of the principle of conservation of energy. Principle of conservation of mass and energy. Energy sources and energy quality. Devices that convert mechanical energy into electrical energy. Generation of X-rays. Devices that convert solar energy into thermal energy. Solar energy converters into electrical energy. Electrical energy converters into heat. The Seebeck and Peltier effects and their use. Examples of combustion processes and their use in technology and energy. Electrochemical cells. Electrical energy accumulators. Devices that store mechanical energy. Electrical light sources. Chemical light sources. Technical use of luminescence. Nuclear fusion and fission reactions. Energy conversion in hydroelectric and pumped storage power plants. Energy conversion in wind power plants. Energy conversion in thermal power plants. Energy conversion in nuclear power plants. Energy conversion in tidal power plants.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>1. Knowledge of the basics of mechanics and electricity. 2. Knowledge of the basics of nuclear physics, atomic physics and quantum mechanics. 3. Knowledge of the basics of chemistry and thermodynamics. 4. Ability to use differential and integral calculus.</td></tr>
<tr><td>Assessment methods and criteria</td><td>
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<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Credit for the course (written form)</td><td>50.0%</td><td>50.0%</td></tr>
<tr><td>Written elaboration of the selected problem</td><td>50.0%</td><td>50.0%</td></tr>
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<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>1. J. Mikielewicz, J.T. Cieśliński ,,Niekonwencjonalne urządzenia i systemy konwersji energii", Maszyny Przepływowe pod red. E.S. Burki. Tom 24. IMP PAN, Ossolineum, Wrocław 1999.</td></tr>
<tr><td>Supplementary literature</td><td>1. F.J.Keller, W.E. Gettys, M.J. Skove ,,Physics"", McGraw-Hill Inc.,US; 2nd Revised edition, 1993.</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>Describe the processes of energy conversion in a wind generator.

Describe the process of energy accumulation in an acid battery.</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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