GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Materials for energy storage and saving, PG_00063621		
Field of study	Materials Engineering		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2025/2026
Education level	second-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	2	Language of instruction	Polish
Semester of study	3	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Institute of Nanotechnology and Materials Engineering -> Faculty of Applied Physics and Mathematics		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Maria Gazda	
	Teachers	prof. dr hab. inż. Maria Gazda	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	15.0	0.0	15.0	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	5.0	50.0	100

Subject objectives

Learning about methods, technologies and materials for energy storage

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_K01] Understands the need for lifelong learning, can inspire and organize the learning process of others. Is aware of own limitations and knows when to turn to experts, can accurately determine priorities helping to achieve the tasks specified by themselves or others.	understands the need for lifelong learning, is aware of his/her own limitations and is able to find ways to overcome them	[SK5] Assessment of ability to solve problems that arise in practice
[K7_U04] Can undertake a detailed analysis of the obtained results and develop a technical report or presentation, also in English.	is able to analyze experimental results and prepare them in the form of a report, also in English	[SU1] Assessment of task fulfilment
[K7_W03] Has extended and enhanced knowledge of mathematics, physics, chemistry and other fields, useful when formulating and solving problems within the scope of materials science.	has extended and in-depth knowledge of mathematics, physics, and chemistry, which he can apply to solving problems related to energy storage	[SW1] Assessment of factual knowledge
[K7_W07] Has knowledge of the development trends and most important new achievements of the fields of science and scientific disciplines relevant to materials engineering and related disciplines.	has knowledge of development trends and the most important new achievements in the field of materials and technologies in energy storage.	[SW2] Assessment of knowledge contained in presentation

<table>
<tr><td>Subject contents</td><td>Lecture: Introduction:1) The need to store energy;2) The need to save energy and use unnecessarily wasted energy;3) Forms of energy and energy conversion; Storage and use of mechanical energy:1) Kinetic energy of rotational motion - flywheel: materials and technologies, examples;2) Potential energy - water reservoirs; 3) Shape memory materials;4) Piezoelectric materials and their use to generate electricity; Storage and use of thermal energy:1) Heating and cooling; phase changes; chemical processes;2) Thermoelectric materials; 3) Thermomagnetic materials;4) Solar collectors;5) Materials for saving thermal energy; Storage of electrical and magnetic energy:1) Battery, cells, capacitors;2) Superelectromagnets; Hydrogen storage as an energy carrier:1) Methods of hydrogen production;2) Methods of hydrogen storage;3) Materials for hydrogen storage; Saving energy and materials.SummarySeminar: Students will independently formulate topics for seminar presentations. Topics will concern the latest achievements, discoveries, technical solutions, devices, etc. related to energy storage and saving. There will be a discussion between students on issues related to energy storage and saving, future forecasts and problems related to recycling modern materials used for energy storage and the concept of critical materials.Laboratory:Students will perform experiments related to energy storage and conversion: PEM fuel cell, photovoltaic cell, photoelectrochemical cell, characteristics of thermoelectric cell, shape memory materials, flywheel.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Basic knowledge of energy conversion required.</td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>written assesment: open questions</td><td>52.0%</td><td>60.0%</td></tr>
<tr><td>presence and lab raport</td><td>52.0%</td><td>20.0%</td></tr>
<tr><td>presentation and presence on seminars</td><td>52.0%</td><td>20.0%</td></tr>
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<tr><td>Recommended reading</td><td>
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<tr><td>Basic literature</td><td>e.g.

Akumulatory, baterie, ogniwa Autor: Andrzej CzerwińskiScientific literature</td></tr>
<tr><td>Supplementary literature</td><td>Scientific literature</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:</td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>1. List the groups of materials used to store hydrogen. Give an example of representatives of these groups and describe one example.2. Thermal/mechanical energy is "present" almost everywhere. Give ways in which it can be stored or used as an additional source of energy. Describe one of the ways you have provided.3. List the methods discussed at MFII that (a) are used to store energy in the form of mechanical energy; (b) use mechanical energy to generate electrical energy. Describe in a bit more detail one example from groups (a) and (b).4. In various technologies, e.g. (a) electronics, (b) construction, (c) energy storage, (d) transportation, materials with special thermal properties are used (e.g. high or low thermal conductivity, high or low latent heat of transformation, high or low specific heat, etc.). Give examples for a-d</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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