GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	ENERGY STORAGE SYSTEMS, PG_00064337		
Field of study	Chemical Technology		
Date of commencement of studies	February 2025	Academic year of realisation of subject	2025/2026
Education level	second-cycle studies	Subject group	Optional subject group Specialty 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	1	Language of instruction	Polish
Semester of study	2	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Energy Conversion and Storage -> Faculty of Chemistry -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Michał Ryms	
	Teachers		

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	30.0	0.0	0.0	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	3.0	27.0	75

Subject objectives

The aim of the course is to provide students with advanced knowledge of the various technologies and systems used for energy storage.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_K02] understands the non-technical aspects and implications of graduate activity, including the impact on the environment	The student understands the environmental impact of different energy storage systems and the need for them in times of climate change	[SK5] Assessment of ability to solve problems that arise in practice
[K7_W02] selects appropriate apparatus and materials for the manufacture and processing of consumer goods	Students will be able to list and indicate the application of different energy storage methods.	[SW1] Assessment of factual knowledge
[K7_U03] designs innovative technological solutions for obtaining useful goods based on the state of the knowledge in accordance with the latest scientific literature	The student is aware of the theoretical and practical operation of various energy storage systems	[SU3] Assessment of ability to use knowledge gained from the subject

<table>
<tr><td>Subject contents</td><td>LECTURE:
1. Energy storage vs. energy extraction from renewable energy sources.
2. Chemical energy storage.
3. Storage of electrochemical energy.
4. Storage of electrical energy.
5. Storage of mechanical energy.
6. Thermal energy storage.
LABORATORY:
1. During the laboratory, students will be divided into groups. Topics:
2. Storage of thermal energy produced by a solar collector
3. Heat storage in phase change materials
4. Electrochemical energy storage
5. Chemical energy storage using hydrogen as an example.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td></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>Laboratory</td><td>60.0%</td><td>50.0%</td></tr><tr><td>Test</td><td>60.0%</td><td>50.0%</td></tr></table></td></tr>
<tr><td>Recommended reading</td><td><table><tr><td>Basic literature</td><td>1. Klugmann-Radziemska E., Lewandowski W., Wilamowska-Zawłocka M., Dettlaff A., Januszewicz K., Ryms M., Kuczyńska-Łażewska A., Energetyka i ochrona środowiska. Generowanie i magazynowanie energii. Odpady energetyczne. Analiza cyklu życia, PWN, 2023
2. G. Jastrzębska, Energia ze źródeł odnawialnych i jej wykorzystanie, WKŁ 2021
3. W. M. Lewandowski, E. Klugmann-Radziemska Proekologiczne odnawialne źródła energii. Kompendium, Wydawnictwo Naukowe PWN, 2017
4. M. Budziszewska, A. Kardaś, Z. Bohdanowicz Klimatyczne ABC. Interdyscyplinarne podstawy współczesnej wiedzy o zmianie klimatu, Wydawnictwa Uniwersytetu Warszawskiego, 2021</td></tr><tr><td>Supplementary literature</td><td>1. Khalid M., Walvekar R., Panchal H., Vaka M., Solar Energy Harvesting, Conversion, and Storage, Elsevier, 2023
2. Chen Y., Energy Harvesting Communications: Principles and Theories, Wiley, 2019</td></tr><tr><td>eResources addresses</td><td></td></tr></table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td></td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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