GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Energy storage systems, PG_00062762						
Field of study	Technologies for Industry 5.0						
Date of commencement of studies	October 2026		Academic year of realisation of subject	2028/2029			
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	3		Language of instruction	Polish			
Semester of study	5		ECTS credits	4.0			
Learning profile	general academic profile		Assessment form	assessment			
Conducting unit	Department of Functional Materials Engineering -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Sebastian Molin					
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	30.0	0.0	0.0	60
	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	60		5.0	35.0		100
Subject objectives	The objective of the course "Energy Storage Systems" is to provide students with a thorough understanding of various energy storagetechnologies and their applications in practical scenarios. Students learn the basic principles of energy storage, such aselectrochemical, thermal, and mechanical storage methods, and how these methods impact the efficiency and stability of energysystems. The course also aims to understand the challenges associated with integrating energy storage into sustainable anddecentralized energy systems.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_W03] demonstrates knowledge on materials used in industrial technologies, their structure and fabrication, knows the principles of conducting research, analyzing it and creating technical documentation	A student achieving this learning outcome will acquire comprehensive knowledge about the materials used in industrial technologies. They will understand their structure and properties, as well as the processes involved in their production. An essential element will be the ability to conduct materials research, which includes planning experiments, performing tests, and analyzing the results obtained. The student will learn to critically evaluate the properties of materials in the context of their industrial applications. Furthermore, they will develop the skill to create professional technical documentation, which is crucial in the work of an engineer. This knowledge and these skills will enable the student to effectively participate in the processes of design, production, and quality control across various industries, contributing to innovation and optimization of technological processes.	[SW1] Assessment of factual knowledge
	[K6_U03] has the ability to plan, prepare and carry out engineering activities using practical knowledge and understanding of the specificity of materials, devices and tools, processes and technologies, and prepare a substantive report	A student achieving this learning outcome will demonstrate the ability to comprehensively manage engineering activities. They will be able to plan, prepare, and execute projects using practical knowledge of materials, devices, tools, processes, and technologies. A key element will be the ability to apply this knowledge practically in real engineering situations. Additionally, the student will develop the skill to synthesize and present the results of their work in the form of a substantive report, which is essential for effective communication in a professional environment.	[SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information
	[K6_K03] effectively, clearly and unambiguously conveys information, describes activities and communicates their results and opinions of a specialist engineer using appropriate communication methods and tools	A student achieving this learning outcome will develop key competencies in effective engineering communication. They will be able to precisely and unambiguously convey technical information, describe engineering activities in detail, and clearly communicate their results. An important element will be the ability to formulate and present opinions from the perspective of a specialist engineer. The student will learn to select and use appropriate communication methods and tools, adapted to various audiences and professional situations. This competency will contribute to effective collaboration in engineering teams and efficient transfer of technical knowledge to both specialists and non-specialists in the field.	[SK4] Assessment of communication skills, including language correctness

Subject contents	Course content – lecture Introduction to Energy StorageEnergy in Traditional Carriers: Coal, Oil, GasBasic Electrochemical Batteries (Lead-Acid, Flow Batteries)Modern Electrochemical Batteries (Lithium-Ion, Flow Batteries)Energy Storage in Electric VehiclesGeneration and Storage of Hydrogen EnergyHydrogen Storage: Hydrides, Compressed, LiquidSupercapacitorsChemical Energy Storage: Methanol, Ammonia, BiofuelsThermal Energy Storage (PCM, Water Systems, Rocks)Mechanical Energy Storage - Compressed Air (CAES), Flywheels, Gravitational Energy StorageHydraulic Energy Storage Systems (PHES)Nuclear Energy - Nuclear FuelEnergy Storage in Energy GridsCase Studies - Analysis of Cases
Prerequisites and co-requisites	
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
final test	50.0%	75.0%
laboratory exercices	80.0%	25.0%

Recommended reading	Basic literature	Barnes F. S., Levine J. G., Large Energy Storage Systems Handbook, CRCPress, Taylor and Francis Group, 2011Ahmed Faheem Zobaa, Energy Storage - Technologies and Applications,InTech 2013. ISBN 978-953-51-0951-8, DOI:10.5772/2550;http://www.intechopen.com/books/energy-storage-technologies-and-applicationsRafi qul Islam Sheikh, Energy Storage, InTech 2010, ISBN 978-953-307-119-0; http://www.intechopen.com/books/energy-storage
	Supplementary literature	1) publications from Elsevier, Wiley publishing houses (and others)2) internet resources
	eResources addresses	
Example issues/ example questions/ tasks being completed	Please describe the basic methods of energy storage in Poland?Please describe a possible energy storage scenario 20 years from now?What technologies can be used for storing energy on a small and large scale?	
Practical activites within the subject	Not applicable	

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