GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Energy Conversion and Nanoionics, PG_00069717		
Field of study	Nanotechnology		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2026/2027
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	6	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Division of New Functional Materials For Energy Conversion -> Institute of Nanotechnology and Materials Engineering -> Faculty of Applied Physics and Mathematics -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Beata Bochentyn	
	Teachers		

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	20.0	0.0	10.0	0.0	0.0	30

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	30	4.0	66.0	100

Subject objectives

The aim of this course is to familiarize students with the issues of modern energy conversion systems and the impact of nanostructuring on their operation. Issues related to nanoionics and electrochemical energy storage in closed systems will also be discussed.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W01] has knowledge of materials science and understands its key role in the progress of civilization	Can explain the properties of materials used in energy conversion devices and the interactions between the components of these devices based on their structure and transport phenomena occurring in the materials.	[SW1] Assessment of factual knowledge
[K6_U06] can accurately present technological and scientific problems, related to the production and application of nanostructures, to specialists in related fields, and initiate and coordinate interdisciplinary cooperation.	Can convey substantive knowledge about the properties and applications of energy conversion materials (e.g., fuel cells, photovoltaic cells, thermoelectric generators) in written and/or oral form. Shares knowledge clearly and understandably. Responds to problem-solving questions. Prepares written reports of completed measurements.	[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
[K6_W07] has systematic knowledge of the physical and chemical principles of nanotechnology (methods of obtaining nanostructures, types of nanostructures, their properties, basic research methods).	Understands the potential application of selected material properties for energy conversion. Knows the impact of nanostructuring on these properties, including ionic conductivity. Knows how to study these properties.	[SW1] Assessment of factual knowledge

Subject contents	LECTURE Students will learn the physical fundamentals of systems such as fuel cells, electrolyzers, thermoelectric devices, and photovoltaic cells. They will learn about the operating parameters of these systems and how to measure them. Students will also acquire knowledge of solid-state nanoionics a new field of knowledge concerning ionic transport phenomena at the nanoscale. Nanoionics will address topics such as trivial and intrinsic scale effects, junction effects, the effect of size on the concentration of ionic charge carriers, and energy storage via job-sharing. LABORATORY In the laboratory, students will examine model energy conversion systems and determine their efficiency. They will also learn about the impact of nanostructuring on the operating parameters of fuel cells and thermoelectric devices.
Prerequisites and co-requisites	Physics basics.
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
Laboratory evaluation	100.0%	50.0%
Written exam	50.0%	50.0%

Recommended reading	Basic literature	Sposób oceniania (składowe) Próg zaliczeniowy Składowa oceny końcowej Pisemne zaliczenie 50% 50% Laboratorium 100% 50% 1. Odnawialne źródła energii. Red. Wichliński, Michał . Częstochowa: Politechnika Częstochowska, 2021, 152 s. ISBN 978-83-7193-867-2 2. Proekologiczne odnawialne źródła energii : kompendium, Lewandowski, Witold M., Klugmann-Radziemska, Ewa Wydawnictwo Naukowe PWN, 2017
	Supplementary literature	Maier J. Nanoionics: ion transport and electrochemical storage in confined systems. Nat Mater. 2005 Nov;4(11):805-15. doi: 10.1038/nmat1513. PMID: 16379070.
	eResources addresses	
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	