GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Hydrogen ecosystems, PG_00064574		
Field of study	Hydrogen Technologies and Electromobility		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2025/2026
Education level	first-cycle studies	Subject group	
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	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Control Engineering -> Faculty of Electrical and Control Engineering -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Adam Kielak	
	Teachers		

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	0.0	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	0.0	0.0	30

Subject objectives

Acquisition of knowledge concerning: Production and application of hydrogen in industry as well as in local cooperatives, communities, and energy clusters. Creation of value chains involving hydrogen to increase energy efficiency. The significance of hydrogen in modern energy systems based on renewable energy sources.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_K01] is aware of the need for continuous education and self-improvement in the field of the profession of an electrician and knows the possibilities of further education	It is looking for the latest information about hydrogen technologies. He/she selects the information found to the issues under consideration.	[SK5] Assessment of ability to solve problems that arise in practice
[K6_U08] can design and build systems and devices related to automation systems, mechatronics and robotics in energy storage devices and in hydrogen installations	Defines the assumptions for the design of control systems. Selects equipment for automation and control systems.	[SU3] Assessment of ability to use knowledge gained from the subject
[K6_W13] knows the properties of materials used in the field of hydrogen energy and electromobility	It selects materials depending the electrochemical and thermodynamic conditions prevailing in hydrogen energy systems.	[SW1] Assessment of factual knowledge
[K6_U05] can use analytical and simulation methods, prepare and for the formulation and solution of tasks in the field of hydrogen technologies, automation and robotics, electrical engineering, use various techniques to carry out engineering tasks related to electrical devices, hydrogen installations, control and robotics systems	It determines the potential of local communities in terms of building an energy ecosystem. It designs value chains involving hydrogen technologies and AI-based control that achive the highest efficiency.	[SU3] Assessment of ability to use knowledge gained from the subject

Subject contents	Definition and key components of hydrogen ecosystems and hydrogen valleys. The role of hydrogen in energy transition and sustainable development. Hydrogen production methods: water electrolysis, methane reforming, biological methods. Analysis of renewable and non-renewable sources in hydrogen production. Hydrogen storage technologies: compressed hydrogen, liquid hydrogen, hydrates. Infrastructure for hydrogen transport: pipelines, tankers, container technologies. Hydrogen fuel cells: operating principle, types, applications in transport and energy. Hydrogen as an energy buffer in renewable energy systems. Safety guidelines for the production, storage, and distribution of hydrogen. Overview of international regulations concerning hydrogen. Principles for creating local hydrogen ecosystems from production to hydrogen utilization. Innovations and new technologies in the hydrogen sector. Scenarios for the future hydrogen economy.
Prerequisites and co-requisites	Basic knowledge of chemistry and organization of energy systems.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Colloquium	60.0%	100.0%

Recommended reading

Basic literature	1. Fennell, P. S., & Sherwood, J. (2023). *Sustainable Hydrogen Energy: Production, Storage & Transportation*. MIT Press. 2. Chmielniak, T., & Chmielniak, T. (2020). *Energetyka wodorowa*. Warszawa: Wydawnictwo Naukowe PWN. 3. International Energy Agency. (2015). Technology Roadmap - Hydrogen and Fuel Cells. Paris: International Energy Agency. Retrieved from https://www.iea.org/reports/technology-roadmap-hydrogen-and-fuel-cells 4. Kamiński, P., & Stępień, R. (2019). *Przemysłowe wykorzystanie wodoru: Przegląd technologii i przyszłe kierunki rozwoju*. Kraków: Wydawnictwo AGH. 5. Nowak, K. (2018). *Elektroliza wody i produkcja zielonego wodoru*. Gliwice: Wydawnictwo Politechniki Śląskiej.
Supplementary literature	1. Fuel Cells and Hydrogen 2 Joint Undertaking. (2021). *Hydrogen Valleys: Insights into the emerging hydrogen economies around the world.* Clean Hydrogen Partnership. 2. Jing, D., & Guo, L. (2021). "Handbook of Hydrogen Energy: The Entire Hydrogen Systems." Wydawnictwo: Wiley.
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	Hydrogen as an energy storage.Hydrogen transport technologies depending on the distance between the place of production and the place of use.Civic energy communities, clusters and energy cooperatives.Hydrogen generation equipment.Equipment used in hydrogen storage and transport technologies. Industrial use of hydrogen.Creating efficient value chains in energy ecosystems.IT systems in energy cooperatives and clusters.Green hydrogen as an ecological raw material.Innovation and new technologies in the hydrogen sector.
Work placement	Not applicable

Document generated electronically. Does not require a seal or signature.