



Subject card

Subject name and code	Hydrogen technologies, PG_00069022						
Field of study	Chemical Technology						
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				3.0	
Learning profile	general academic profile	Assessment form				assessment	
Conducting unit	Department of Process Engineering and Chemical Technology -> Faculty of Chemistry -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Donata Konopacka-Łyskawa					
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	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	10.0		35.0	75	
Subject objectives	The course introduces students to the properties of hydrogen as a fuel and as a raw material in the chemical industry. It covers traditional and alternative methods of hydrogen production, as well as technologies for its storage, distribution, and utilization in e-fuel synthesis. Students will gain both theoretical knowledge and practical skills in electrolysis, fuel cells, on-demand hydrogen production hydrogen purification and simulation of the economic feasibility of hydrogen-related investments.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K6_W07] Has knowledge of raw materials and technologies in the chemical and polymer industries, also covering issues of corrosion and material protection.	has knowledge of the properties and production of hydrogen and the raw materials for its manufacture.			[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects		
	[K6_K03] Understands the need for continuous learning and knows the opportunities to improve professional, personal and social competences, and is able to think and act in an entrepreneurial manner.	is ready to continuously improve his professional competences related to hydrogen production technologies and to assess the costs associated with its manufacture.			[SK5] Assessment of ability to solve problems that arise in practice		

Subject contents	Course content – lecture											
	Lecture (15 h): 1. Properties of hydrogen as a fuel and as a raw material in the chemical industry (1 h) 2. Traditional methods of hydrogen and syngas production (3 h) 3. Conversion of methane, coal, and hydrocarbons with steam: a) Gasification of solid fuels, partial oxidation of natural gas b) Pyrolysis c) Dehydrogenation of alcohols and hydrocarbons, gasoline isomerization, laboratory methods of hydrogen production 4. Water electrolysis technologies and fuel cells (2 h) 5. Alternative hydrogen production methods: on-demand production using liquid hydrogen carriers (LOHC, methanol, ammonia) (2 h) 6. Alternative hydrogen production methods: thermochemical water splitting, photoelectrochemical water splitting, photobiological processes, microbiological biomass conversion (1 h) 7. Hydrogen purification, carbon dioxide capture and storage (1 h) 8. Hydrogen storage and distribution (2 h) 9. Utilization of hydrogen and waste carbon dioxide for e-fuel synthesis (3 h)											
	Course content – laboratory											
	Laboratory (15 h): 1. Water electrolysis and fuel cells 3 h 2. On-demand hydrogen production (6 h): 2.1. Electrochemical decomposition of ammonia 3 h 2.2. Steam reforming of methanol 3 h 3. Simulation of hydrogen investment profitability computer laboratory 2 × 3 h = 6 h											
Prerequisites and co-requisites	1. Knowledge of inorganic and organic chemistry. 2. Knowledge of chemical thermodynamics. 3. Ability to work with standard laboratory equipment. 4. Fundamental knowledge of chemical technology.											
Assessment methods and criteria	<table border="1"> <thead> <tr> <th>Subject passing criteria</th> <th>Passing threshold</th> <th>Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td>Laboratory - completing exercises, tests, reports</td> <td>100.0%</td> <td>40.0%</td> </tr> <tr> <td>Lecture - Test</td> <td>60.0%</td> <td>60.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Laboratory - completing exercises, tests, reports	100.0%	40.0%	Lecture - Test	60.0%	60.0%
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Lecture - Test	60.0%	60.0%										
Recommended reading	Basic literature	1. M. Nowicki, Wodór paliwem przyszłości? PWN 2025 2. K. S. V.Santhanam, R. Iosifovič, M. J. Massoud, G. A. Takacs, A. V. Bailey, Introduction to hydrogen technology, Wiley 2018 3. J. Surygała, Wodór jako paliwo, Wydawnictwo Naukowo-Technologiczne, 2008.										
	Supplementary literature	1. Handbook of Fuels: Energy Sources for Transportation, ed. B. Elvers, A. Schutze, Wiley-VCH GmbH, 2022.										
	eResources addresses											
Example issues/ example questions/ tasks being completed	1. Describe the properties of hydrogen as a fuel and compare them with conventional fuels. 2. Explain how a PEM fuel cell works. 3. Explain the process of producing hydrogen on demand from methanol and ammonia.											
Practical activities within the subject	Not applicable											

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