GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Safety standards in hydrogen research, PG_00065894		
Field of study	Hydrogen Technologies and Electromobility		
Date of commencement of studies	October 2022	Academic year of realisation of subject	2024/2025
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	6	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Katedra Inżynierii Materiałów Funkcjonalnych WETI -> Faculty of Electronics, Telecommunications and Informatics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Milena Marycz	
	Teachers	dr inż. Milena Marycz	

Lesson types and methods of instruction

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	3.0	17.0	50

Subject objectives

Course objective (in English):

The objective of the course is to provide students with knowledge and skills related to occupational safety in chemical, microbiological, and technological laboratories, with particular focus on processes associated with hydrogen energy. Students will learn the principles of safe and responsible laboratory work, including handling hazardous chemicals, explosive gases, high-pressure equipment, and microorganisms. Furthermore, students will develop competencies in risk assessment, the creation of standard operating procedures (SOPs), the implementation of safety protocols, and responding to hazards in laboratory environments.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[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	Identifies elements of laboratory apparatus related to hydrogen technology. Assesses risks associated with laboratory work, including tasks involving hydrogen, explosive gases, and high-pressure laboratory equipment. Selects appropriate preventive measures for handling hazardous materials, including hydrogen, in accordance with laboratory safety procedures.	[SU2] Assessment of ability to analyse information
[K6_W13] knows the properties of materials used in the field of hydrogen energy and electromobility	Selects materials appropriately based on the requirements of the applied hydrogen research method.	[SW1] Assessment of factual knowledge
[K6_K02] can work in a group taking on different roles in it	Carries out tasks in a group, divides work, assigns responsibilities, and collaboratively analyzes issues related to the implementation and adherence to safety standards within technological and/or engineering projects.	[SK3] Assessment of ability to organize work

Subject contents	LECTURE: Types of laboratories. Scale and characteristics of processes. Safety procedures. Preventive measures. Legal requirements. Characteristics of chemical and physical factors. Hazardous processes. Factors and parameters affecting process hazards. Preparation for work in high-risk laboratories. Responding to laboratory work hazards. Explosive gases. Procedures and standards for working with hydrogen. Working with high pressures. Bioreactors. Microbiological factors. Safe work with microorganisms. Safe work with hazardous samples. Types of poisonings and burns. Development of SOPs (Standard Operating Procedures) for laboratory equipment and technological processes. Risk assessment. Development of workplace safety standards dedicated to specific laboratories. LABORATORY EXERCISES: Exploration of laboratory apparatus and equipment. Development of Standard Operating Procedures (SOPs). Risk assessment. Safety procedures and hazard response protocols in laboratory work.
Prerequisites and co-requisites	
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
Written test	50.0%	50.0%
Reports on laboratory exercises	50.0%	50.0%

Recommended reading	Basic literature	Sherif, S. A., Goswami, D. Y., Stefanakos, E. L., & Steinfeld, A. (Eds.). (2014). *Handbook of hydrogen energy*. CRC press. Wiśniewski, B., & Policji, W. W. S. (Eds.). (2018). *Bezpieczeństwo w teorii i badaniach naukowych*. Wydział Wydawnictw i Poligrafii Wyższej Szkoły Policji. Nims, D. (1999). *Basics of industrial hygiene* (Vol. 1). John Wiley & Sons. Recommended articles during classes
	Supplementary literature	Phase, M. J. Handbook for hydrogen-fuelled vessels. *Energy conversion*, *5*(0). Rigas, F., & Sklavounos, S. (2008). Hydrogen safety. In *Hydrogen Fuel* (pp. 547-580). CRC Press. Kozak, A. (2011). Bezpieczeństwo procesowe w obiektach przemysłowych. *Budownictwo i inżynieria Środowiska*, *2*(3), 319-322. Calabrese, M., Portarapillo, M., Di Nardo, A., Venezia, V., Turco, M., Luciani, G., & Di Benedetto, A. (2024). Hydrogen safety challenges: a comprehensive review on production, storage, transport, utilization, and CFD-based consequence and risk assessment. *Energies*, *17*(6), 1350.
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	Prepare an SOP for a high-pressure apparatus, considering potential hazards and emergency procedures. Conduct a risk analysis for a process, considering potential ignition sources, gas leaks, and pressure valve failures. Perform a risk assessment for a technological process involving an exothermic reaction at high temperature and pressure. Develop a list of safety requirements and standards for a research laboratory dealing with fermentation processes in bioreactors. How to assess the risk of working with explosive or flammable substances such as hydrogen? What parameters influence the risk associated with working with explosive gases? How should one proceed in the event of an emergency with high-pressure equipment? What are the key process parameters that influence safety (e.g., temperature, pressure, reagent toxicity)?	
Work placement	Not applicable	

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