



Subject card

Subject name and code	Intelligent and Sustainable Processes of Industry 5.0, PG_00069683						
Field of study	Recycling and Energy Recovery						
Date of commencement of studies	October 2024		Academic year of realisation of subject		2026/2027		
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		4.0		
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		prof. dr hab. inż. Lidia Jasińska-Walc				
	Teachers		prof. dr hab. inż. Lidia Jasińska-Walc				
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	20.0	0.0	30.0	0.0	10.0	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	Familiarizing students with modern technologies for improving large scale industrial processes. From sustainable production processes to humanmachine collaboration in Industry 5.0. Introducing participants to the broadly understood concept of the circular economy.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_U07] creates solutions aimed at implementing legal regulations and managing raw materials/ waste on the premises of the company, as well as organizing work in accordance with legal standards and health and safety regulations.		The student has knowledge of company law and regulations, as well as health and safety issues.		[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU1] Assessment of task fulfilment		
	[K6_U03] designs processes, technologies and systems related to the recovery of raw materials and energy, using appropriate concepts, standards and design methods.		The student is able to apply appropriate research methods to solve a technological problem.		[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment		
	[K6_W05] analyzes practical issues in the field of recovery of raw materials and energy, using knowledge and understanding of: materials, devices and tools, processes and technologies.		The student recognizes the potential in the commercialization of a product or technology.		[SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge		
	[K6_W06] integrates and extracts data from multiple sources to analyze complex engineering and technology problems.		The student is able to assess the significance of a cognitive and practical problem.		[SW2] Assessment of knowledge contained in presentation		

Subject contents	Course content – lecture Industry 5.0: the concept of humanmachine integration emphasizing the value of the human factor in production processes (4h). Introduction to petrochemical processes and the production of chemical products in the light of European Union regulations and the Industry 5.0 concept. General issues related to the circular economy (4h). Crude oil and gas processing and contemporary transformations of refining processes (4h). Catalysis: types of catalysts, their applicability in chemical processes, trends in the development of chemical compounds and polymers using homogeneous and heterogeneous catalysts in the context of circular economy requirements (4h). Petroleum- and gas-derived chemical products versus materials obtained from renewable sources: raw material origins, life-cycle analysis of products, recycling processes of materials including biodegradation and recovery of raw materials and energy (4h). Asphalt modification processes and testing of fundamental asphalt properties as well as its recycling. Rheological analysis of materials and evaluation of their processing conditions, recycling, and raw material recovery. Design of production processes with consideration of circular economy principles. Analysis of the impact of production processes on the environment and human health. Assessment of environmental and economic risks in production processes in line with the Industry 5.0 concept.		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Lecture	60.0%	100.0%
Recommended reading	Basic literature	Industry 5.0 Human, Ecology, Stability EU documentation and selected scientific publications from ACS sources. M. Paczuski, A. Lorek, M. Przedlacki: Petroleum Product Technology. Publishing House of Warsaw University of Technology, 2024. G. Ashcroft: Unconventional Oil Production in the USA. KS OmniScriptum Publishing, 2020. Z. Florjańczyk, S. Penczek: Polymer Chemistry. Publishing House of Warsaw University of Technology, 2002. A. Błędzki, R. Jeziórska, J. Kijeński: Recycling of Polymeric Materials. PWN Scientific Publishers, 2011. Integrated Reports of the Groups: Saudi Aramco, LOTOS and Orlen S.A. (20002024).	
	Supplementary literature	Nahavandi, S. (2019). Industry 5.0A Human-Centric Solution. Sustainability, 11(16), 4371. European Commission (2021). Industry 5.0: Towards a Sustainable, Human-Centric and Resilient European Industry. Publications Office of the European Union. Clark, J., & Deswarte, F. (2015). Introduction to Chemicals from Biomass (2nd ed.). Wiley. Jens Hagen (2015). Industrial Catalysis: A Practical Approach (3rd ed.). Wiley-VCH. Speight, J. G. (2020). The Chemistry and Technology of Petroleum (6th ed.). CRC Press.	
	eResources addresses		
Example issues/ example questions/ tasks being completed	Definition and assumptions of the Industry 5.0 concept. Assumptions of the circular economy. Refining processes: fundamentals of the process and its modifications aimed at environmental protection. The recent heterogeneous and homogeneous catalysts selecting the appropriate catalyst for process requirements. What are the advantages and disadvantages of chemical products derived from renewable sources?		
Practical activites within the subject	Not applicable		

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