GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Intelligent and sustainable processes of Industry 5.0, PG_00069287		
Field of study	Chemical Technology		
Date of commencement of studies	February 2025	Academic year of realisation of subject	2025/2026
Education level	second-cycle studies	Subject group	
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	2	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Laboratory of Applied Macromolecular Materials -> 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		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	15.0	0.0	15.0	45

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	45	5.0	25.0	75

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
[K7_K82] is equipped to participate actively in lectures, seminars and laboratory classes conducted in foreign language	The student has knowledge of company law and regulations, as well as health and safety issues.	[SK1] Assessment of group work skills [SK4] Assessment of communication skills, including language correctness
[K7_U03] designs innovative technological solutions for obtaining useful goods based on the state of the knowledge in accordance with the latest scientific literature	The student is able to apply appropriate research methods to solve a technological problem.	[SU5] Assessment of ability to present the results of task
[K7_K01] critically evaluates the content of cognitive and practical problems	The student is able to assess the significance of a cognitive and practical problem.	[SK2] Assessment of progress of work
[K7_W03] selects methods of data analysis, including statistical and modelling, useful for solving scientific and technological problems	The student recognizes the potential in the commercialization of a product or technology.	[SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects
[K7_U08] assesses the potential for commercialisation of a product or technology based on an analysis of scientific publications and patents	The student recognizes the potential in the commercialization of a product or technology.	[SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools

Subject contents

Course content – lecture

1. Industry 5.0: the concept of humanmachine integration emphasizing the value of the human factor in production processes (4h).
2. 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).
3. Crude oil and gas processing and contemporary transformations of refining processes (4h).
4. 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).
5. 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).
6. Asphalt modification processes and testing of fundamental asphalt properties as well as its recycling.
7. Rheological analysis of materials and evaluation of their processing conditions, recycling, and raw material recovery.
8. Design of production processes with consideration of circular economy principles.
9. Analysis of the impact of production processes on the environment and human health.
10. Assessment of environmental and economic risks in production processes in line with the Industry 5.0 concept.

Course content – laboratory

1. Asphalt modification processes and testing of fundamental asphalt properties as well as its recycling.
2. Rheological analysis of materials and evaluation of their processing conditions, recycling, and raw material recovery.

Course content – seminar

1. Design of production processes with consideration of circular economy principles.

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

Przemysł 5.0 człowiek, ekologia, stabilność dokumentacja EU oraz wybrane publikacje naukowe ze źródeł ACS.

M. Paczuski, A. Lorek, M. Przedlacki: Technologia produktów naftowych. Oficyna Wydawnicza Politechniki Warszawskiej, 2024.

G. Ashcroft: Niekonwencjonalna produkcja ropy naftowej w USA. KS OmniScriptum Publishing, 2020.

Z. Florjańczyk, S. Penczek: Chemia polimerów. Oficyna Wydawnicza Politechniki Warszawskiej, 2002.

A.Błędzki, R. Jeziórska, J. Kijeński: Recykling materiałów polimerowych, Wydawnictwo Naukowe PWN, 2011.

Raporty Zintegrowane grup: Saudi Aramco, LOTOS i Orlen S.A. (2000-2024).

	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. T he 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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