GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00069683		
Field of study	Inteligentne i zrównoważone procesy przemysłu 5.0		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2025/2026
Education level	first-cycle studies	Subject group	Optional 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 -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Lidia Jasińska-Walc	
	Teachers	prof. dr hab. inż. Lidia Jasińska-Walc Weronika Nowicka	

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_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.	[SW1] Ocena wiedzy faktograficznej [SW2] Ocena wiedzy zawartej w prezentacji
[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] Ocena wiedzy zawartej w prezentacji
[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.	[SU1] Ocena realizacji zadania [SU3] Ocena umiejętności wykorzystania wiedzy uzyskanej w ramach przedmiotu [SU4] Ocena umiejętności korzystania z metod i narzędzi
[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.	[SU1] Ocena realizacji zadania [SU2] Ocena umiejętności analizy informacji [SU3] Ocena umiejętności wykorzystania wiedzy uzyskanej w ramach przedmiotu [SU4] Ocena umiejętności korzystania z metod i narzędzi

<table>
<tr><td>Subject contents</td><td>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.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td></td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Lecture</td><td>60.0%</td><td>100.0%</td></tr>
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<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>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).</td></tr>
<tr><td>Supplementary literature</td><td>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.</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>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?</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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