



Subject card

Subject name and code	Green inorganic technologies, PG_00057603						
Field of study	Green Technologies						
Date of commencement of studies	October 2023	Academic year of realisation of subject			2026/2027		
Education level	first-cycle studies	Subject group			Obligatory subject group in the field of study 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	4	Language of instruction			Polish		
Semester of study	7	ECTS credits			2.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Chemistry and Technology of Functional Materials -> Faculty of Chemistry -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Marek Lieder					
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	0.0	0.0	30
	E-learning hours included: 0.0						
	eNauczanie source address: https://enauzanie.pg.edu.pl/moodle/course/view.php?id=46407						
	Additional information: stationary classes						
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	2.0	18.0	50		
Subject objectives	<ol style="list-style-type: none"> 1. Learning about low-emission technologies and those based on renewable raw materials. 2. Comparing technologies for manufacturing the same product from renewable and non-renewable raw materials. 						
Learning outcomes	Course outcome	Subject outcome		Method of verification			
	[K6_W02] has a basic knowledge of chemistry including general chemistry, inorganic, organic, physical, analytical, including the knowledge necessary to describe and understand the phenomena and chemical processes occurring in the environment; measurement and the determination of the parameters of these processes.	The student uses the acquired knowledge to understand technological processes. The student proposes changes to existing technologies aimed at reducing emissions and waste production.		[SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge			
	[K6_K06] has awareness of the importance of non-technical aspects and effects of engineering activities, including its impact on the environment and the associated responsibility for decisions.	Awareness of the importance of the impact of processes on the natural environment and the need to minimize negative effects.		[SK1] Assessment of group work skills [SK5] Assessment of ability to solve problems that arise in practice [SK3] Assessment of ability to organize work			
	[K6_W06] has a basic knowledge of chemical engineering, mechanical engineering and chemical equipment, knows and understands basic processes taking place in green, proenvironmental technologies	The ability to design new processes and modify existing ones in accordance with the requirements of green technologies and sustainable development.		[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects			

Subject contents	<p>Course content – lecture Is zero-emission soda production technology possible? Physicochemical basis of soda production using the Solvay process. Sources of greenhouse gas and particulate matter emissions. Methods of reducing and utilising them. Modifications to the Solvay process the Dual and SCS methods.</p> <p>Production of sulphuric acid (VI) from raw materials recovered from exhaust gases and metallurgical processes. Reduction of sulphur oxide emissions through single-stage and multi-stage conversion. Recycling of spent vanadium catalysts.</p> <p>Production of white phosphorus and phosphoric acid (V) from mineral raw materials and anthropogenic sewage sludge. Analysis of the environmental impact of both approaches.</p> <p>Production of phosphate fertilisers and environmental consequences</p> <p>Ammonia synthesis: improved Haber-Bosch technology and alternatives.</p> <p>Production of nitric acid, urea and ammonium nitrate. Advanced methods for reducing nitrogen oxide emissions from waste gases.</p> <p>Water in industry. Treatment for energy purposes.</p> <p>Energy production through the combustion of low-emission fuels. Clean hydrogen production.</p> <p>Chlorine production using environmentally friendly membrane electrolyzers.</p> <p>Non-ferrous metal smelting. The problem of flotation waste.</p>								
Prerequisites and co-requisites	<ul style="list-style-type: none"> Basic knowledge of technology and chemical engineering 								
Assessment methods and criteria	<table border="1"> <thead> <tr> <th data-bbox="448 1106 798 1144">Subject passing criteria</th> <th data-bbox="802 1106 1142 1144">Passing threshold</th> <th data-bbox="1147 1106 1487 1144">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="448 1151 798 1249">Solving design, technological, and environmental problems presented during classes. Group work.</td> <td data-bbox="802 1151 1142 1249">60.0%</td> <td data-bbox="1147 1151 1487 1249">100.0%</td> </tr> </tbody> </table>	Subject passing criteria	Passing threshold	Percentage of the final grade	Solving design, technological, and environmental problems presented during classes. Group work.	60.0%	100.0%		
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Recommended reading	<p>Basic literature</p> <p>Supplementary literature</p> <p>eResources addresses</p>	<p>Suresh C. Ameta, Rakshit Ameta, Green Chemistry Fundamentals and Applications, 2014; https://doi.org/10.1201/b15500</p> <p>Miguel A. Esteso, Ana Cristina Faria Ribeiro, A. K. Haghi, Chemistry and Chemical Engineering for Sustainable Development. Best Practices and Research Directions, 2020; https://doi.org/10.1201/9780367815967</p> <p>Shrikaant Kulkarni, Ann Rose Abraham, A. K. Haghi, Renewable Materials and Green Technology Products Environmental and Safety Aspects, 2021; https://doi.org/10.1201/9781003055471</p> <p>Current scientific articles devoted to the discussed. issues.</p>							
Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> How do we limit nitrogen oxide emissions in nitric acid production technology? What methods do you know for utilising the basic catalyst for sulphuric acid production? What are the most important chemical and technological challenges in chlorine production? 								
Practical activities within the subject	Not applicable								

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