



Subject card

Subject name and code	Green Organic Technologies, PG_00036303						
Field of study	Green Technologies						
Date of commencement of studies	October 2020	Academic year of realisation of subject			2023/2024		
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			3.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Chemistry and Technology of Functional Materials -> Faculty of Chemistry						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Anna Skwierawska					
	Teachers	dr hab. inż. Anna Skwierawska					
Lesson types and methods of instruction	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						
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	10.0		35.0		75
Subject objectives	<ol style="list-style-type: none">To acquaint students with the principles of green technology design.To acquaint students with examples of processes that meet the principles of sustainable development.Learning about examples of processes based on renewable raw materials.Comparison of the production processes of the same product from renewable and non-renewable raw materials.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
Subject contents	Introduction to green chemistry. The Twelve Principles of Green Chemistry. Innovative aspects of green chemistry. Green organic reactions "on water" and in superheated water. Green "solvent free" organic reactions. Introduction to sustainable development. Examples of green technologies in heavy organic technology. Examples of green technologies in the pharmaceutical industry. Examples of green technologies in the production of polymers. Green detergents and plant protection products. Green polymers and dyes. Green organic catalysts. Other modern technologies based on renewable raw materials. Comparison of the production processes of hydrogen, alkenes and fuels from biomass with similar processes using methane. Organic adsorbents used in water treatment.						
Prerequisites and co-requisites	Knowledge of industrial analytical techniques. Knowledge of organic chemistry . Knowledge of basic techniques of water, air and soil protection . Basic knowledge of technology and chemical engineering . knowledge of green inorganic technologies.						

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	First written tests. Open and closed questions. The duration of the test is 60 minutes.	60.0%	50.0%
	The second written tests. Open and closed questions. The duration of the test is 60 minutes.	60.0%	50.0%
Recommended reading	Basic literature	1. Nicholas E. Leadbeater, Microwave Heating as a Tool for Sustainable Chemistry, 2010; https://doi.org/10.1201/97814398127096 . 1. Andrew P. Dicks, Green Organic Chemistry in Lecture and Laboratory, 2012; https://doi.org/10.1201/b11236 1. Suresh C. Ameta, Rakshit Ameta, Green Chemistry Fundamentals and Applications, 2014; https://doi.org/10.1201/b15500 2. Vera M. Kolb, Green Organic Chemistry and Its Interdisciplinary Applications, 2016; https://doi.org/10.1201/9781315371856 3. 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 1. 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	
	Supplementary literature	Scientific articles directly related to the topic in question.	
	eResources addresses	Adresy na platformie eNauczenie: Zielone Technologie Organiczna - Moodle ID: 34133 https://enauczenie.pg.edu.pl/moodle/course/view.php?id=34133	
Example issues/ example questions/ tasks being completed	1. Based on the calculated environmental parameters, make the right choice of raw materials for the process. 2. Discuss examples of technologies implemented in solvent-free conditions. 3. What are the limitations of these methods? 4. Environmental problems resulting from the use of biomass in the production of hydrogen. 5. Environmental problems in the production of natural dyes and detergents. Is bioethanol dehydration an example of green technology? 6. Is propene production from waste glycerin obtained during biodiesel production really a green technology?		
Work placement	Not applicable		