

Subject card

Subject name and code	Environmental technologies for sustainable development, PG_00159520						
Field of study	Chemistry						
Date of commencement of studies	October 2023		Academic year of realisation of subject		2025/2026		
Education level	Bachelor's 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		1.0		
Learning profile	academic		Assessment form		credit		
Conducting unit	Laboratory of Photocatalysis -> Department of Environmental Technology -> Faculty of Chemistry -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Anna Malankowska				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	0.0	0.0	15
	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	15		2.0		10.0	27
Subject objectives	1. Familiarizing students with methods of wastewater, air and soil purification. 2. Familiarizing students with the characteristics of renewable energy sources. 3. Familiarizing students with methods of obtaining solar, wind and geothermal energy (heat pumps, photovoltaic cells, solar collectors, windmills). 4. Developing the ability to independently conduct an experiment, 5. The ability to apply the methodology given in the instructions and interpret the obtained results, 6. The ability to present the results in writing.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[CHEML3_W05] Has basic knowledge of the chemical specialisation studied.	The student presents correct technological reasoning in an understandable way, both orally and in writing.	[SW4] test/exam - oral or written [SW1] oral statement/conversation/discussion
	[CHEML3_U07] Prepares documented elaboration on a specific problem in the field of selected chemical and physical issues.	The student independently searches for information in the literature	[SU3] text preparation/written work
	[CHEML3_K05] Observes established procedures in laboratory work and is responsible for the safety of her/his and others' work.	The student follows established research procedures	[SK1] oral statement/conversation/discussion
	[CHEML3_U03] Selects the appropriate equipment and laboratory apparatus for conducting uncomplicated chemical experiments.	The student lists and characterizes basic technologies used for purifying sewage, water and air	[SU3] text preparation/written work [SU4] test/exam - oral or written
	[CHEML3_W06] Chooses higher mathematics techniques to the extent necessary to understand and describe the physical processes important for understanding chemistry.	The student predicts, verifies and criticizes the results of conducted experiments	[SW3] text preparation/written work
Subject contents	Topics related to wastewater treatment: unit processes used for wastewater treatment: aeration, coagulation, sedimentation, flotation, filtration, straining, ion exchange, chemical precipitation, chemical oxidation. Advanced oxidation technologies for wastewater treatment (AOP). Selection of appropriate treatment methods depending on the quality of wastewater. Topics related to air purification: selected methods of reducing the content of pollutants in exhaust gases; dust removal and SO₂ removal. CO₂ separation and storage methods. Topics related to soil purification: methods of remediation of contaminated soils (physicochemical, thermal and biological methods). Topics related to renewable energy: methods of obtaining solar, wind, geothermal, tidal energy. Heat pumps. Photovoltaic cells. Solar collectors. Windmills.		
Prerequisites and co-requisites	A. Formal requirements 1. general chemistry, 2. inorganic chemistry, 3. analytical chemistry. B. Prerequisites 1. knowledge of basic laboratory techniques; 2. ability to use chemical terminology and nomenclature; 3. knowledge of the properties of chemical elements and compounds and states of matter; 4. knowledge of basic types of chemical reactions; 5. knowledge of basic properties and reactivity of inorganic compounds;		

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Written test	51.0%	100.0%
Recommended reading	Basic literature	Presentation materials used during classes	
	Supplementary literature	1. Zaleska A., Zielińska-Jurek A., Soil remediation technologies, PG Publishing House, Gdańsk 2013 2. Koniecznyński J.: Waste gas purification, Silesian University of Technology, Gliwice 1990. 3. E. Kulgman-Radziemska, Lewandowski W., Proecological renewable energy sources Compendium, PWN Scientific Publishing House, 2017. 4. Kowal A.L., Świdzka-Bróż M., Water purification, PWN Scientific Publishing House, Warsaw 2007	
	eResources addresses		
Example issues/ example questions/ tasks being completed	1. Explain what determines the choice of soil remediation technique? Describe thermal methods used for soil remediation. 2. Explain how to reduce the emission of sulfur compounds into the atmosphere. 3. List methods for reducing CO2 into the atmosphere. Explain what CO2 sequestration methods consist of. 4. Propose a sequence of wastewater treatment processes (in the form of a block diagram) contaminated with: colloidal compounds, microorganisms, solid pollutants, and organic compounds. 5. Explain what advanced methods of pollutant oxidation consist of (list the methods used and characterize them). 6. Describe the operating principle of a heat pump, solar collector, and photovoltaic cells.		
Work placement	Not applicable		

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