University of Gdańsk

Subject card

Subject name and code	Advanced Technologies of Environmental Remediation, PG_00199737		
Field of study	Business and Environmental Technology		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2026/2027
Education level	Master's 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	1	Language of instruction	Polish
Semester of study	2	ECTS credits	5.0
Learning profile	academic	Assessment form	exam
Conducting unit	Laboratory of Photocatalysis -> Department of Environmental Technology -> Faculty of Chemistry -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Ewelina Grabowska-Musiał	
	Teachers	dr hab. inż. Ewelina Grabowska-Musiał dr Magdalena Miodyńska-Melzer	

Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	22.0	0.0	23.0	45.0	0.0	90
	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	90	0.0	35.0	125

Subject objectives
• familiarizing students with the classification and sources of pollution of individual elements of the ecosystem • familiarization with selected soil remediation technologies • familiarize students with modern oxidation processes used in environmental remediation • developing the ability to conduct an experiment independently • ability to apply the methodology given in the manual and interpret the obtained results • ability to present results in writing

Learning outcomes

Course outcome	Subject outcome	Method of verification
[BiTEMU2_U05] is able to give a presentation and independently prepare various specialized written works appropriate for the field studied or in the area on the border of various scientific disciplines, using theoretical approaches, collecting various sources of data, their description and interpretation, and drawing conclusions based on scientific literature and the results of own research work	based on acquired knowledge and use of multimedia programs, prepares and delivers an oral presentation	[SU2] presentation/project/paper/ report
[BiTEMU2_U06] uses advanced methods, techniques, and tools to assess the quality of the environment and the effectiveness of the technological processes used	is able to select appropriate methods to check the effectiveness of the applied water, soil or air purification processes	[SU1] oral statement/conversation/ discussion [SU8] observation of student's independent or team work
[BiTEMU2_W01] provides an in-depth analysis of the relationship between economics and environmental technology, and their place within the social and natural sciences.	can independently describe existing problems regarding the impact of environmental degradation on economic aspects	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion [SW5] implementation of a problem task
[BiTEMU2_W10] explains in detail the mechanisms of unit processes used in remediation and environmental protection as well as waste management methods	rozróżnia i omawia podstawowe procesy stosowane w inżynierii środowiska	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion
[BiTEMU2_K02] understands the need to cooperate and work in a group, assuming responsible roles within it	can solve given problems independently and together with a group	[SK6] demonstration of practical skills [SK8] observation of student's independent or team work
[BiTEMU2_W11] has an in-depth understanding of and applies safety and hygiene rules when working independently at a research or measurement station in the laboratory or in the field at an advanced level	applies safety rules at work	[SW1] oral statement/ conversation/discussion [SW5] implementation of a problem task
[BiTEMU2_U08] searches, selects and analyzes the literature on environmental sciences, including scientific journals and databases, reading and understanding scientific texts in the native language and English	can independently search for and interpret literature from the best scientific databases in the world	[SU2] presentation/project/paper/ report [SU8] observation of student's independent or team work
[BiTEMU2_U09] plans and performs research tasks in the field or laboratory and interprets research results on environmental protection issues	independently plans research experiments and interprets the results	[SU1] oral statement/conversation/ discussion [SU5] implementation of a problem task [SU6] demonstration of practical skills [SU8] observation of student's independent or team work
[BiTEMU2_W09] predicts the effects of human interference in the natural environment and analyzes the impact of human activity on the quality of the environment on a local, regional and global scale	based on the latest literature and course topics, independently discusses problems related to environmental degradation	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion [SW2] presentation/project/paper/ report
[BiTEMU2_U07] proposes processes and methods of water treatment, sewage and waste gas treatment, environmental remediation, and waste management used in environmental protection	depending on the needs and problems, it proposes appropriate processes used in environmental remediation	[SU1] oral statement/conversation/ discussion [SU6] demonstration of practical skills [SU8] observation of student's independent or team work
[BiTEMU2_K07] demonstrates responsibility for the safety of one's own work and that of others, taking into account the risks resulting from the research techniques used, and creates conditions for safe work in the laboratory or in the field	on the basis of occupational safety regulations learned during studies, controls their compliance at the workplace	[SK8] observation of student's independent or team work

	Course outcome	Subject outcome	Method of verification
	[BiTEMU2_K03] understands the need to properly set priorities, plan and organize tasks related to their implementation, as well as monitor and evaluate progress	independently plans and coordinates experimental work	[SK8] observation of student's independent or team work

Subject contents

A. Topics of the lecture:

Classification and sources of soil, water and air pollution. Classification of technologies used for soil remediation, water and sewage treatment and air purification. Modern oxidation processes used in environmental remediation. Radiation technologies used for water and sewage purification and sewage sludge hygienization. Selected soil remediation technologies used in in-situ and ex-situ conditions. Selected air purification technologies. Selected technologies for eliminating oil spills. Advanced development technologies municipal and hazardous waste. Technologies for purifying leachate from landfills.

B. Problems of laboratory exercises carrying out exercises thematically related to the purification of soil, sewage, leachate and air (technological and qualitative aspects)

Prerequisites and co-requisites

No requirements

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
exam	51.0%	100.0%

Recommended reading

Basic literature	Grabowska-Musiał Ewelina., unpublished materials, made available to students during classes Zadroga B., Olańczuk-Neyman K., Ochrona i rekultywacja podłoża gruntowego, Wydawnictwo Politechniki Gdańskiej 2001 Surygała J. (Red.) Zanieczyszczenia naftowe w gruncie, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2000 Gworek B., Barański A., Kondzielski I., Kucharski R., Sas-Nowosielska A., Małkowski E., Nogaj K., Rzychoń D., Worsztynowicz A., Technologie rekultywacji gleb. Monografia IOR, Warszawa 2004 Lewandowski W., Techniczno-technologiczne i aparaturowe aspekty ochrony powietrza, WPG, Gdańsk 2011
Supplementary literature	brak
eResources addresses	

Example issues/ example questions/ tasks being completed

1. List and briefly discuss the main sources of atmospheric pollution 2. List and briefly discuss methods for reducing sulfur emissions into the atmosphere 3. Discuss in detail three selected methods of removing sulfur from solid fuels 4. Draw a diagram of the installation and, based on it, discuss the Claus process of desulfurization of crude oil and petroleum products 5. Draw a diagram of the installation and, based on it, discuss the process of hydrodesulfurization of crude oil and petroleum derivatives 6. List and briefly discuss the methods of flue gas desulfurization 7. Draw a diagram of the installation and, based on the drawing, discuss the principle of coal desulfurization using the difference in the density of coal and pyrite 8. Discuss the lime-lime method as an example of the wet method used for flue gas desulfurization 9. List and briefly discuss methods of reducing CO2 emissions into the atmosphere 10. List and briefly discuss the methods of separating CO2 from exhaust gases 11. List and briefly discuss the methods of geological storage of CO2 12. What determines the choice of water treatment technology? 13. Describe the characteristics of slow and fast filters. Explain what it is and how it works. 14. Discuss one selected method for removing hardness from water 15. Discuss the method of iron removal/demanganization of water 16. Discuss the coagulation process (type of impurities removed during coagulation, mechanism, coagulants used) 17. Discuss the role of activated carbon in sorption processes 18. What is the water disinfection process. What parameters influence the course and effectiveness of this process. Briefly discuss one selected method. 19. Discuss the flotation process used in water purification processes 20. Discuss the ion exchange process used in water purification processes. What are the stages of this process and what parameters affect its effectiveness. 21. Explain the differences between the composition of municipal and industrial sewage 22. What is the purpose of wastewater treatment? Classification of sewage treatment plants 23. Discuss the mechanical methods used to treat sewage 24. Discuss the biological methods used to treat wastewater 25. Describe the principle of operation of an SBR reactor 26. What are biological deposits. When do we use them? What are their advantages and disadvantages? 27. Explain the difference between activated sludge and biological deposits. 28. Discuss one selected method of advanced oxidation of pollutants. Where do we use AOP methods? 29. What are sewage sludges and how are they formed? Discuss the chemical composition of sewage sludge 30. Briefly discuss the properties of sewage sludge 31. How can the volume of sewage sludge be reduced. Briefly discuss known methods. 32. Discuss the equipment used for drying sewage sludge 33. Discuss the process of composting sewage sludge 34. Explain the process of stabilizing sewage sludge. List and discuss the methods used to stabilize sediments. 35. Discuss the process of sewage sludge incineration 36. Discuss the classification of soil remediation methods. What determines the choice of remediation method for contaminated soil? 37. List and critically discuss physicochemical methods of soil reclamation used in in-situ conditions 38. Draw an example diagram of an installation for soil cleaning using the vacuum method in in-situ conditions and discuss the process on this basis 39. Draw an example diagram of an installation for soil purification using the chemical oxidation method in in-situ conditions and discuss the process on this basis

Work placement

Not applicable