GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00062832		
Field of study	Recycling and Energy Recovery		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2023/2024
Education level	first-cycle studies	Subject group	Obligatory subject group 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	4.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department Of Environmental Engineering Technology -> Faculty Of Civil And Environmental Engineering -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Katarzyna Jankowska	
	Teachers	dr hab. Katarzyna Jankowska dr inż. Agnieszka Kalinowska dr hab. inż. Edyta Malinowska-Pańczyk mgr inż. Emilia Bączkowska	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	20.0	0.0	30.0	0.0	0.0	50
	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	50	5.0	45.0	100

Subject objectives	The aim of the course is to recall and systematise knowledge of micro-organisms and their role in the environment and to extend knowledge of self-purification processes including the potential for their application to specific engineering problems, e.g. safe drinking water and wastewater treatment.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_U02] solves engineering issues and problems in the area of raw materials and energy recovery through the use of appropriate analytical, numerical and experimental tools and methods.	- The student will understand the roles and mechanisms of living organisms involved in natural self-purification processes of surface water, including the potential for their use in wastewater treatment. - The student will demonstrate innovation and creativity in designing and adapting technologies and processes to solve specific engineering challenges, taking into account emerging threats such as pathogenic bacteria, possibly drug resistant.	[SU3] Assessment of ability to use knowledge gained from the subject [SU5] Assessment of ability to present the results of task
	[K6_U01] applies knowledge of mathematics and other exact sciences and engineering disciplines to solve theoretical, engineering and technological problems and issues.	The students will be able to apply mathematical methods, using the concepts of arithmetic and geometric mean to convert cell counts from different environments (e.g. air, water) to evaluate and analyse biological data. - The student will use chemical knowledge to analyse the composition of media and the effects of different chemical agents (e.g. chlorine, ozone, oligodynamic action, phenolic factor) on micro-organisms, to assess the effectiveness of antibacterial agents and to understand disinfection processes. - The students will use physical knowledge to understand the effects of UV radiation on micro-organisms, the principles of microscopy including phase contrast microscopy, electron microscopy, etc. and the effect of wavelength of light on microscopic observations - The student understands and analyses the effects of environmental factors such as temperature and pH on micro-organisms and applies biological knowledge to evaluate and predict their responses under different conditions. - The student integrates knowledge from different scientific disciplines to comprehensively analyse and solve engineering and technological problems, especially those related to treatment and disinfection in the context of public health and environmental safety. - The student will apply theoretical knowledge from mathematics, chemistry, physics and biology to practical applications in the laboratory and in real engineering situations involving experimentation, analysis and interpretation of data. - The student will be able to critically evaluate different methods and technologies used in microbiology and environmental engineering, taking into account their effectiveness, efficiency and environmental impact.	[SU3] Assessment of ability to use knowledge gained from the subject [SU5] Assessment of ability to present the results of task

Course outcome	Subject outcome	Method of verification
[K6_W02] analyzes engineering and technological issues and problems in the area of raw materials and energy recovery using appropriate and appropriate analytical, numerical and experimental tools and methods	- The student will understand the basic concepts related to water disinfection and wastewater treatment, the action of antibacterial agents (bactericides, bacteriostats) and the diversity of organisms (psychrophiles, mesophiles, thermophiles) and their importance in technological processes. - The student will be able to evaluate the effectiveness and efficiency of various technologies and methods, such as periodic disinfection of water supply networks, in the context of their application to specific engineering problems, e.g. ensuring the safety of drinking water and wastewater treatment. - The student will be able to use experimental and analytical methods such as microbiological cultures, sterile laboratory procedures, microscopy. - The student will understand the roles and mechanisms of living organisms involved in natural self-purification processes of surface water, including the potential for their use in wastewater treatment. - The student will demonstrate innovation and creativity in designing and adapting technologies and processes to solve specific engineering challenges, taking into account emerging threats such as pathogenic bacteria, possibly drug resistant.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation
[K6_W01] demonstrates knowledge and understanding of mathematics and other exact sciences and engineering disciplines at the level necessary to solve theoretical, engineering and technological problems and issues.	- The student will apply theoretical knowledge from mathematics, chemistry, physics and biology to practical applications in the laboratory and in real engineering situations involving experimentation, analysis and interpretation of data. - The student will be able to critically evaluate different methods and technologies used in microbiology and environmental engineering, taking into account their effectiveness, efficiency and environmental impact.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects

Subject contents

Lectures: Micro-organisms as the basic agents of nature in the cycle of matter. Characteristics of micro-organisms and their role in the aquatic environment. Self-purification of water, unit processes, oxygen line. Saprobic index. Growth of micro-organisms and their nutritional requirements. Metabolism. Kinetics of enzymatic reactions. Energy sources for heterotrophs; aerobic respiration, anaerobic respiration, fermentation. Energy sources for autotrophs: lithotrophs and phototrophs. Microbiological threats to water quality. Effects of physical and chemical factors on microorganisms (including disinfection methods). Basics of biological methods of wastewater treatment: activated sludge, biological beds. Biological methods for the removal of nitrogen and phosphorus from wastewater. Anaerobic treatment and sludge disposal. Sanitary aspects of wastewater and sludge treatment. Biological stability of water supplies.Laboratories: Fundamentals of microscopy techniques. Microscopic analysis of microorganisms found in natural waters. Determination of saprobic index. Bacterial growth on solid and liquid media, bacterial staining, morphology and structure of the bacterial cell. Effects of environmental factors on microorganisms. Bacteriological analysis of water and air including indicator bacteria. Biocenosis of activated sludge and biological membrane.

Prerequisites and co-requisites

Basic knowledge of biology, chemistry and ecology.

<table>
<tr><td>Assessment methods and criteria</td><td colspan="2"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Lectures - exam 2 parts</td><td>60.0%</td><td>60.0%</td></tr>
<tr><td>Laboratories - attendance, reports</td><td>100.0%</td><td>40.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>Laboratorium z biologii środowiska, Krystyna Olańczuk-Neyman. Skrypt, Politechnika Gdańska

Mikrobiologia techniczna, tom 1, Red. Z. Libudzisz, K. Kowal, Z. Żakowska. Wydawnictwo Naukowe PWN Warszawa 2021.Błaszczyk M.K.:

Mikroorganizmy w ochronie środowiska, Wydawnictwo Naukowe PWN Warszawa 2007. Błaszczyk M.K.:

Mikrobiologia środowisk, Wydawnictwo Naukowe PWN Warszawa 2010. Wastewater Microbiology, Gabriel Bitton, John Wiley & Sons, 2005 R.M. Atlasa, R. Bartha:

Microbial Ekology. Addison-Wesley Publishing Company, Reading 1981 Water Quality Assessments: Ed. Chapman&Hall, London 1992 Microbial Enzymes in Aquatic Environments: Ed. R.J. Chróst Springer Verlag New York 1991</td></tr>
<tr><td>Supplementary literature</td><td>Życie bakterii, Kunicki Goldfinger W.J.H. Wydawnictwo Naukowe PWN, Warszawa 2006.

Mikrobiologia Wód, Red. J. Paluch PWN, Warszawa 1973.

Biologia Wód Śródlądowych, Mikulski J., PWN Warszawa 1974.

Mikrobiologia ogólna, Schlegel H.G., Wydawnictwo Naukowe PWN, Warszawa 2005.

Mikrobiologia Krótkie wykłady, Nicklin J., Graeme-Cook K., Paget T., Killington R., Wydawnictwo Naukowe PWN, Warszawa 2021,</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2"></td></tr>
<tr><td>Work placement</td><td colspan="2">Not applicable</td></tr>
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