GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Ecosystem biology, PG_00057675						
Field of study	Green Technologies						
Date of commencement of studies	October 2025		Academic year of realisation of subject	2026/2027			
Education level	first-cycle studies		Subject group	Optional subject group			
Mode of study	Full-time studies		Mode of delivery	at the university			
Year of study	2		Language of instruction	Polish			
Semester of study	3		ECTS credits	3.0			
Learning profile	general academic profile		Assessment form	assessment			
Conducting unit	Department of Microbiology -> Faculty Of Chemistry -> Wydziały Politechniki Gdańskiej						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. Beata Zalewska-Piątek				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	30.0	0.0	0.0	45
	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	45	5.0	25.0	75

Subject objectives	Expanding knowledge in the field of interdependence between the environment and organisms inhabiting the biosphere, ecotoxicology and toxicity tests, mutagens and environmental mutagenesis, biomarkers and basic bioindication issues.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U01] is able to obtain information from literature, databases and other sources, is able to integrate the information obtained, to make their interpretation, as well as draw conclusions and formulate and justify opinions, take part in the discussion	The student searches databases for information on the assessment of the genotoxic effect of mutagens released into the environment.	[SU4] Assessment of ability to use methods and tools
[K6_W04] is aware of the importance of environmental protection and has a basic knowledge of chemical and biological threats to the environment, with particular emphasis on anthropogenic factors, has a basic knowledge of knowledge of the principles of sustainable development as well as national and European environmental management conditions.	Student analyzes anthropogenic factors causing pollution of abiotic elements of the environment: water, air and soil.	[SW3] Assessment of knowledge contained in written work and projects
[K6_U04] capable of formulating and solving design tasks in the field of environmental technology to recognize their non-technical aspects, including environmental, economic and legal. Is capable of applying the principles of occupational health and safety. Is able to make initial assessment of engineering solutions and actions	The student performs a toxicity test on plants to assess the condition of the soil environment.	[SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment
[K6_K01] understands the need for learning throughout life, can inspire and organize the learning process of others. Is aware of his/ her own limitations and knows when to ask the experts, can properly identify priorities for implementation, critically evaluate his knowledge	The student uses the knowledge of lichens to assess the degree of air pollution.	[SK2] Assessment of progress of work [SK3] Assessment of ability to organize work

Subject contents	**LECTURE** **Explanation of the concept of biology and environmental biology.** The development of biology at the turn of the century. **Characteristics of selected groups of organisms inhabiting the biosphere.** Prokaryotic and eukaryotic organisms, cell structure. Bacteria, structure, size and morphological forms. More important cellular structures of bacteria. General characteristics of fungi. The main groups of fungi of utility importance. **Genome as the complete genetic information of a cell.** Prokaryotic and eukaryotic genomes. **Mutations, mutagens and environmental mutagenesis.** Assessment of genotoxic effects caused by environmental pollutants (tests detecting point mutations - Ames test; cytogenetic and molecular tests - micronucleus assay, comet test, Tunnel test, fluorescence *in situ* hybridization, FISH). **Biomarkers in the assessment of the environmental exposure of organisms to pesticides and other toxic compounds.** Classification of biomarkers. Inhibition of acetylcholinesterase (AChE) and delta aminolevulinic acid dehydratase (ALAD) by organophosphorus and organochlorine compounds, pyrethroids and lead as an extremely toxic heavy metal. Lowering the activity of coagulation proteins by coumarin and its derivatives. Induction of vitellogenin (by estrogenic pollutants in male fishes) and monooxygenases (by organochlorine compounds, polycyclic aromatic hydrocarbons). Masculinization of female snails induced by androgenic pollution. Porphyrin profiles and heme group synthesis (disturbances in the heme biosynthetic pathway induced e.g. by organochlorine compounds, drugs and other xenobiotics). **Fundamentals of ecotoxicology.** Toxic substances and measurable toxic effects (LC_{50}, LD_{50}, NOED, NOEC, EC_{50}, ED_{50}). Features of test organisms. Bioindication as a method of environmental assessment. Classification and review of bioindicators (natural environmental species and breading species). Toxicity classification system, screening test and dilution test for the analysis of environmental samples (sample classes). **Review of toxicity tests based on land and water organisms.** Toxicity tests based on cryptobiotic forms of bioindicators. **Lichens as a bioindicators of air pollutions.** Sensitivity of lichens to pollution. The lichen scale and the transplantation of lichen thallus from poorly contaminated areas to the studied areas. Methods of lichen transplantation used in atmospheric air biomonitoring. The importance of lichens in nature and human economy. **LABORATORY** **Organizational classes.** Familiarization with occupational health and safety (OHS) regulations in the experimental laboratory and handling of biological material**.Methods of determining the number of microorganisms in natural environments.** Determination of the number of bacteria by the method of surface and deep plating. Determination of the number of microorganisms in the tested material by means of the titre and NPL (the most probable number of microorganisms on the basis of the Mac Cradys statistical table). **Microbiological analysis in the assessment of the sanitary condition of soil, water and air.** Identification of ammonification bacteria in soil samples. Observations of bacterial growth (medium turbidity, the presence of scum, sediment), analysis of the pH of the culture medium and the presence of ammonia with the Nessler reagent. Determination of the total number of bacteria and fungi in the air with the sedimentation method. Identification of the presence of coliform bacteria in the tested water samples by the test tube fermentation method using the medium with lactose and bromocresol purple as an acid-base indicator (LPB, Eijkman medium), determination of the coliform titre. **Analysis of the degree of toxicity of the soil environment in relation to the test plant species (*Sorghum saccharatum*, *Lepidium sativum*, *Sinapis alba*)** using a phytotoxicity microbiotest (Phytotoxkit). Determination of the degree of inhibition of seed germination and root growth along the length of the tested plants in the presence of toxic compounds in the soil. **Growth inhibition analysis based on aquatic higher plants *Spirodela polyrhiza* based on the Spirodella DUCKWEED microbiotest for testing pure substances, sewage, surface and deep waters.** Preparation of media (growth and dilution), a series of dilutions of the test sample, turions for germination. Measurement of the area of the largest leaf of each sprouting turion in each test well at the beginning and end of the test in the tested water samples in relation to the control. **Summary of the obtained research results.**
Prerequisites and co-requisites	Basic knowledge of ecology and general microbiology.
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
Complex grades including laboratories and lecture. Final score (%) = lab score - passes and reports (%) x 0.5 + lecture - final test (%) x 0.5.	60.0%	100.0%

Recommended reading	Basic literature	**Weiner J.** Life and Evolution of the Biosphere. PWN. 2005. **Walker C.H., Hopkin S.P., Sibly R.M., Peakall D.B.** Fundamentals of ecotoxicology. PWN. 2002. **Brown T.A.** Genomes. PWN. 2009. **Beata Zalewska-Piątek, Marcin Olszewski, Rafał Piątek.** Environmental biology. Edited by Beata Zalewska-Piątek. Publishing House of the Gdańsk University of Technology. 2019. **Anna Brillowska-Dąbrowska, Marta Wanarska, Beata Zalewska-Piątek, Rafał Piątek, Józef Kur.** Fundamentals of genetic engineering. Chapter 2. Publishing House of the Gdańsk University of Technology. 2014
	Supplementary literature	**Wójciak H.** Lichens, bryophytes, ferns. MULTICO. 2003.
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	Characteristics of selected groups of organisms inhabiting the biosphere. Mutations, mutagens and environmental mutagenesis. Analysis of genotoxic effects caused by environmental pollutants based on toxicity tests. Lichens as bioindicators of air pollution. Biomarkers in the assessment of exposure of organisms to toxic compounds released into the environment.	
Work placement	Not applicable	

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