COURSE DESCRIPTION CARD

BIALYSTOK UNIVERSITY OF TECHNOLOGY								**Faculty of Civil Engineering and Environmental Sciences**		
Field of study								**Level and form of study**	Full-time Bachelor Degree	
A group of modules /specialty	common subject							**Education profile**	Academic profile	
Course name	Biochemistry with protein analysis							**Course code**	IS-FCEE-00135-1S	
								Course type		
Course form(s) and number of hours	**L**	**C**	**LC**	**P**	**SW**	**FW**	**S**	**Semester**	**summer**	
	15		30					**ECTS credits**		**4**
The programme is valid from	2026/2027									
Introductory courses										

Course objectives	To familiarize students with the concepts of nucleic acid and protein biochemistry and methods of their extraction from biological material, purification, and quantitative and qualitative determination; to present methods for studying the basic properties of sugars, lipids, and vitamins and their determination in biological material; to familiarize students with a systematic approach to protein analysis, combining their mapping with functional characterization; to familiarize students with the basic elements of protein analysis, new trends and directions of development in proteomics, as well as research methods and techniques; to present methods of fractionation, isolation, and studies of protein structure and properties; to prepare students for conducting scientific research.
Framework programme content	Nucleic Acids. Genes and Chromosomes (Prokaryotes and Eukaryotes). Spectrophotometry of Nucleic Acids. The Concept of the Genome and Proteome, the Definition of Proteomics. The Substantive Scope, Advanced Research Strategies, and Contributions to Modern Life Sciences. Biosynthesis and Regulation of Protein Expression. The Biochemical Cycle of Proteins from Synthesis to Degradation. Description of the Proteome Based on Knowledge and Analysis of the Genome, Comparison of the Proteomes of Various Organisms. Elements of Advanced Proteomic Analysis. Electrophoretic Methods in Proteomics: Overview of Selected Research Techniques, Including Two-Dimensional Electrophoresis. Methods for Isolating and Studying Proteins of Various Origins: Tissue Homogenization, Concentration of Protein Solutions, Ultracentrifugation, Ultrafiltration, Salting-Out, and Precipitation Techniques; Chromatography. Selected Methods for Studying Protein Structure and Properties.
Other information about the course	content of the course refers to the principles of sustainable development the course is related to the scientific activity conducted at the University

Calculation:

Student workload related to:	**Total number of hours**	**including contact**	**including practical**
participation in lectures	15	15	
participation in other forms of activities	30	30	30
individual substantive support of the learning process, participation in exams/assessments organized outside the scheduled classes	2	2	1,3
completion of professional training	0	0	0
preparation for the exam	5		
preparation for the credit	48		48
Total number of hours:	**100**	**47**	**79**
Total number of ECTS credits:	**4**	**1,9**	**3,2**

Expected discipline learning outcomes	Knowledge	Skills	Social competence
	BT1_W01 BT1_W06	BT1_U03	BT1_K04

Objectives and framework content prepared by	dr hab. Agata Jabłońska-Trypuc, prof. PB	Date:	2026-03-24

Implementation in the academic year **2026/2027**

Programme content

	Lecture
1	The structure of nucleic acids and genome organization.
2	Nucleoproteins - structure and properties.
3	General principles of isolating nucleic acids and nucleoproteins.
4	The structure of proteins.
5	Protein properties.
6	Methods for qualitative and quantitative assessment of proteins in biological samples.
7	The concept of genome and proteome, the definition of proteomics. The substantive scope and research strategies, and the contribution to the achievements of modern life sciences.
8	Biosynthesis and regulation of protein expression. The biochemical cycle of proteins from synthesis to degradation.
9	Description of the proteome based on knowledge and analysis of the genome, comparison of the proteomes of various organisms.
10	Electrophoretic methods in proteomics: discussion of selected research techniques, including two-dimensional electrophoresis.
11	Methods for the isolation and analysis of proteins of various origins in proteomics - tissue homogenization, concentration of protein solutions, ultracentrifugation, ultrafiltration, salting out, precipitation techniques; chromatography.
12	Simple and complex carbohydrates. Plant and animal polysaccharides.
13	Carbohydrate metabolism: glycolysis, the Krebs cycle, gluconeogenesis.
14	Carbohydrate metabolism: fructose, galactose, and glycogen metabolism.
15	Fatty acids and their physiologically important derivatives. Lipids — structure and properties. The structure of biological membranes.
	Laboratory classes
1	Organizational activities: principles of work in a biochemistry laboratory, regulations for conducting laboratory classes in the subject of structural and metabolic biochemistry.
2	Proteins as colloids. Protein solubility and salting out. Protein denaturation.
3	Quantitative determination of protein content by the Lowry method in various biological samples.

	4	Quantitative determination of protein content by ultraviolet absorbance measurement and the Bradford method in various biological samples
	5	Electrophoretic separation of proteins from various biological samples by vertical polyacrylamide gel electrophoresis.
	6	Extraction, isolation, and purification of crude RNA from biological material. Obtaining RNA from yeast.
	7	Purification of the crude RNA obtained in laboratory class 6.
	8	Isolation of ribonucleoproteins from animal tissues. Isolation of ribonucleoproteins from bovine thymus (or pancreas). Part I. RNP extraction.
	9	Isolation of ribonucleoproteins from bovine thymus (or pancreas). Part II. Preparation of the RNP preparation.
	10	Characteristic reactions of sugars.
	11	
	12	
	13	
	14	
	15	
Teaching methods (on-site classes)	L	informative and problem-based lecture with multimedia presentation
	LC	experiment
Teaching methods (online classes)	L	informative and problem-based lecture with multimedia presentation
Forms of crediting	L	written exam with closed-ended test questions
	LC	evaluation of the reports; test
Conditions of crediting	L	Students take the exam in a session. The exam consists of 10 questions, with 1 point awarded for each question. Grades are awarded according to the following formula: 51% - 60% of the total points are satisfactory 61% - 70% of the total points are satisfactory+ 71% - 80% of the total points are good 81% - 90% of the total points are good+ 91% - 100% of the total points are very good
	LC	As part of the laboratory exercises, students complete ten practical exercises, working in groups of two or three. Assessment of the exercises is based on the test and reports on the experiments. Students can receive a maximum of 5 points for the test, and 2 points for the report. Grades are awarded according to the following formula: 51% - 60% of the total points are satisfactory 61% - 70% of the total points are satisfactory+ 71% - 80% of the total points are good 81% - 90% of the total points are good+ 91% - 100% of the total points are very good

Outcome symbols	**Expected learning outcomes**	**Expected learning outcomes defined for the field of study**		
		Knowlegde	Skills	Social competence
	Knowledge: the student knows and understands			
E1	the advanced mathematical and physical principles of thermodynamics and how they govern bioenergetic coupling and metabolic spontaneity; the chemical structures and physical properties of biopolymers; the intricate regulatory networks of primary metabolism and the biochemical pathways of secondary metabolites, which serve as the foundation for metabolic engineering	BT1_W01		
E2	the structural and functional relationships in biochemistry, proteomics, and enzymology, specifically how the primary sequence of a protein dictates its folding and catalytic efficiency in industrial biocatalysis; the intersection of microbiology, genetics, and genetic engineering, understanding how to manipulate microbial genomes to overexpress specific proteins or alter metabolic flux for increased bioproduct yield; the principles of organic, analytical, and physical chemistry as they apply to biological systems, including the mechanisms of organic reactions in metabolic pathways and the physical laws of molecular thermodynamics	BT1_W06		
	Skills: the student can			
E3	plan and conduct complex biochemical and process experiments, integrating knowledge of enzymology and genetics to optimize the production of recombinant proteins or metabolites; document laboratory and pilot-scale processes with rigorous precision, ensuring traceability and reproducibility according to GLP (Good Laboratory Practice) and industrial standards; perform measurements of critical physical and chemical parameters (e.g., dissolved oxygen, pH, metabolic heat, and substrate concentration) using advanced analytical instrumentation.		BT1_U03	
	Social competence: the student is ready to			
E4	be guided by the principles of professional ethics, demonstrating honesty in the documentation of biochemical data and intellectual property, and rejecting any form of scientific misconduct or plagiarism; require ethical behavior from others, fostering a culture of integrity in the laboratory and industrial workplace, and intervening when safety protocols or ethical standards are compromised			BT1_K04

Outcome symbols	**Methods of verification of learning outcomes**	**Course form subject to verification**
E1	*exam; test; preparation of laboratory reports*	L, LC

E2	*exam; test; preparation of laboratory reports*	L, LC	
E3	*exam; test; preparation of laboratory reports*	L, LC	
E4	*exam*	L	
Basic references	1 *Stenesh, J. Biochemistry. Springer, 2013. Print.*		
	2 *Briggs, Thomas, and Albert M Chandler. Biochemistry. 3rd ed. Springer, 2012. Print. Oklahoma Notes.*		
	3 *Brambl, Robert, and George A Marzluf. Biochemistry and Molecular Biology. Springer, 2013. Print. The Mycota.*		
Supplementary references	1 *Poian, Andrea T. da, and Miguel A. R. B Castanho. Integrative Human Biochemistry. Springer, 2015. Print.*		
	2 *Lennarz, William. Biochemistry of Glycoproteins and Proteoglycans. Springer, 2012. Print.*		
Course coordinator	*dr hab. Agata Jabłońska-Trypuć, prof. PB*	**Date:**	*24.03.2026*