University of Gdańsk

Subject card

Subject name and code	Biotechnology - mathematics, physics, chemistry Foundations (M01_B2), PG_00192247		
Field of study	Biotechnology		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2026/2027
Education level	Bachelor's 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	1	ECTS credits	6.0
Learning profile	academic	Assessment form	exam
Conducting unit			
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Stanisław Ołdziej, prof. UG	
	Teachers	dr hab. Stanisław Ołdziej, prof. UG dr hab. Agnieszka Chylewska, prof. UG prof. dr hab. Krzysztof Liberek dr hab. Piotr Szuca dr hab. Elżbieta Jankowska, prof. UG dr hab. Marek Józefowicz, prof. UG	

Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	76.0	0.0	0.0	0.0	0.0	76
	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	76	10.0	64.0	150

Subject objectives	The student, by completing the program block, will acquire advanced knowledge in the sciences and life sciences necessary for understanding biological phenomena and processes, in particular cellular processes at the molecular level

Learning outcomes

Course outcome	Subject outcome	Method of verification
[BIOTECHL3_W06] The graduate possesses structured and advanced knowledge of exact and natural sciences necessary to understand biological phenomena and processes, in particular cellular processes at the molecular level.	The student interprets and explains biological phenomena and processes, in particular cellular processes at the molecular level, based on the laws and principles of chemistry, physics and mathematics.	[SW4] test/exam - oral or written

Subject contents	F1. General chemistry - 16h Theoretical and practical issues of applied chemistry in research and technology:Types of matter: atom, element, isotope, chemical compound; their characteristics and mass (relative and absolute), abundance (mole; Avogadro's number). Atomic issues: structure of the atom, atomic models and subatomic particles and their relevance to technology (principles of research instruments). Basic chemical laws in practice: conservation of mass, volume ratios, Dalton's and Clapeyron's gas laws. Inorganic compounds: oxides, hydrides, hydroxides, acids, salts; structure, obtaining, chemical properties, potency. Chemical equations: synthesis, analysis, exchange, redox, specific reactions, stoichiometry. Solutions: real, standard, standard, standard, weight, buffer (types, composition, capacity, selection criteria), electrolytes, ionic dissociation, pH scale, pH measurement methods, pH indicators, protolytic reactions in aqueous salt solutions. Ways of expressing concentrations of solutions: percent concentrations, molar concentrations, ppm, ppb. Equilibrium reactions: thermodynamic equilibrium, the rule of perversity, energy effects, bioprocesses, optimization of chemical and biological processes. F2 Bioorganic chemistry - 20h Concept of acidity/alkalinity in organic chemistry - isomerism: constitutional, geometric, configurational, conformational - groups of organic compounds, their nomenclature and properties - mechanisms in organic chemistry (nucleophilic, electrophilic and free radical substitution, nucleophilic and electrophilic addition, elimination) - properties and reactions of alcohols and thiols - properties and reactions of aldehydes and ketones - properties and reactions of carboxylic acids and their derivatives - properties and reactions of aliphatic, aromatic, heterocyclic amines F3. Mathematics - 20h Sequences (number e) - Overview of elementary functions (inverse function) - Boundary and continuity of functions, properties of continuous functions - Differentiation of functions, applications of derivative - Indeterminate integral of a function, selected methods of integration - Definite and improper integral, applications of integration F4. Elements of biophysics - 5h Selected issues of nuclear physics: properties of nuclear forces, nuclear transformations, law of radioactive decay, interaction of nuclear radiation with matter, application of isotopes in other sciences - sedimentation methods (centrifugation) in biological sciences F5 Physics - 15h Tools of physics and its relations with other sciences. - Interactions in nature - Elements of kinematics: description of motion of a material point, types of motion, systems of reference, relativity of motion. Elements of dynamics: definition of force, Newton's principles of dynamics. Law of universal gravitation. Work, energy, power. Principles of conservation in mechanics. - Elements of rigid body mechanics. - Oscillatory and wave motion: harmonic oscillator, mechanical waves and wave phenomena. Thermodynamics: selected concepts of thermodynamics, kinetic theory of a perfect gas, principles of thermodynamics, reversible and irreversible processes. - Electricity and magnetism: properties and description of electric and magnetic fields. Electric potential. Electric current: Ohm's law, Kirchhoff's laws, current and voltage measurements. Motion of charge in electric and magnetic fields. Magnetic moment. - Electromagnetic waves, their properties and applications.
Prerequisites and co-requisites	
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
Comprehensive integrating exam	50.0%	40.0%
F1-F5	51.0%	60.0%

Recommended reading	Basic literature	1. D. Halliday, R. Resnick, J. Walker, Postawy fizyki (t. 1-5), Wydawn. Naukowe PWN, Warszawa, 2003 (dodruki 2005-2017). 2. J. Orear, Fizyka (t. 1 i 2), Wyd. Naukowo-Techniczne, Warszawa, 2004 (i późniejsze dodruki). 3. B. Jaworski, A. Dietłaf, (t.3 L. Miłkowska) Kurs fizyki (t. 1-3), PWN 1984. 4. G. Kwiecińska, Matematyka, cz. I, II i III, Wydawnictwo UG, 2001 5. L. Jones, P. Atkins Chemia ogólna. Cząsteczki, materia, reakcje, Wydawnictwo Naukowe PWN, 2004 (i późniejsze dodruki).; 6. T. Kędrya Chemia ogólna z elementami biochemii, Wydawnictwo Zamiast korepetycji, Kraków 2001; 7. John McMurry Chemia organiczna, Wydawnictwo Naukowe PWN 8. Paula Yurkanis Bruice Organic chemistry, Pearson Education Limited 9. Skrypt "Biofizyka z elementami fizyki" S. Ziętkiewicz 10. Podstawy biofizyki. Podręcznik dla studentów medycyny, pod redakcją Andrzeja Pilawskiego, PZWL
	Supplementary literature	1. G. M. Fichtencholz, Rachunek różniczkowy i całkowy, t. 1, 2 i 3, PWN, 1985. 2. F. Leja, Rachunek różniczkowy i całkowy, PWN, 1969. 3. Biofizyka dla biologów. Red. M. Bryszewska, W. Leyko, PWN
	eResources addresses	
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	

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