UNIWERSYTET MEDYCZNY
IM. PIASTÓW ŚLĄSKICH WE WROCŁAWIU

Appendix to Resolution No.2303
of Senate of Wroclaw Medical University
of 28 April 2021 r.

Syllabus for academic year: 2023/24

Description of the course			
Course	Biochemia z elementami chemii (2)	**Group of detailed education results**	
	Biochemistry with elements of chemistry (2)	**Group of classes (group code):** B	**Group name:** Scientific basis of medicine
Faculty	Faculty of Medicine		
Major	English Division - Faculty of Medicine		
Level of studies	uniform MA studies		
Form of studies	full-time		
Year of studies	2	**Semester of studies**	winter
Type of course	obligatory		
Language of study	English		

Number of hours

Form of education

	(L)	(SE)	(AC)	(MC)	(CC)	(LC)	(CSC)	(PCP)	(FLC)	(PE)	(VP)	(DSS)	(EL)
Semestr zimowy:													
Katedra Biochemii i Immunochemii:	10	10				40							
Kształcenie bezpośrednie:	0	10				40							
Kształcenie zdalne:	10	0				0							
Razem w roku:													
Katedra Biochemii i Immunochemii:	10	10				40							
Kształcenie bezpośrednie:	0	10				40							
Kształcenie zdalne:	10	0				0							

Lectures (L); Seminars (SE); Auditorium classes (AC); Major Classes - not clinical (MC); Clinical Classes (CC); Laboratory Classes (LC); Classes in Simulated Conditions (CSC); Practical Classes with Patient (PCP); Foreign language Course (FLC), Physical Education (PE); Vocational Practice (VP); Directed Self-Study (DSS), E-learning (EL)

Educational objectives (max. 6 items)

C1: Provide the students with the knowledge on the structure, properties, function and metabolic processes of the basic groups of chemical compounds in norm and pathology

C2: Equip the students with the abilities of performing biochemical calculations and of interpretation of the results of conducted experiments

C3: Familiarize students with the basic scientific techniques applied in biomedical studies

C4: Creation of biochemical foundations enabling the students to gain in-depth understanding of molecular mechanisms underlying various disorders, important in subsequent stages of medical education as well as in a future professional career as medical doctor.

C5: Shaping attitudes promoting scientific reliability, by stressing the importance of precision and repeatability of laboratory measurements as well as diligence in biochemical calculations and development of efficiency and manual precision as aptitudes and abilities necessary during the work in students laboratory as well as in a future professional career as medical doctor.

C6: Development social competences needed to practice the medical profession, in accordance with graduate's profile.

Education result for course in relation to verification methods of the intended education result and the type of class:

Number of detailed education result	Student who completes the course knows/is able to	Methods of verification of intended education results	Form of didactic class
B.W1.	the water-mineral balance of biological systems;	Written exams in a form of MCQ, MRQ tests, a choice of yes/no answers, matching answers, with open questions. Standardized oral exams focused on the evaluation of knowledge on the level of understanding, analysis, synthesis, problem solving. Written tests in a form of short essays, reports, short structured questions	WY, CA, CL
B.W2.	the acid-base balance and the mechanism of action of buffers and their importance in body homeostasis;	Written exams in a form of MCQ, MRQ tests, a choice of yes/no answers, matching answers, with open questions. Standardized oral exams focused on the evaluation of knowledge on the level of understanding, analysis, synthesis, problem solving. Written tests in a form of short essays, reports, short structured questions	WY, CA, CL
B.W3.	the terms: solubility, osmotic pressure, isotonia, colloidal solutions and Gibbs-Donnan effect;	Written exams in a form of MCQ, MRQ tests, a choice of yes/no answers, matching answers, with open questions. Standardized oral exams focused on the evaluation of knowledge on the level of understanding, analysis, synthesis, problem solving. Written tests in a form of short essays, reports, short structured questions	WY, CA, CL
B.W4.	the basic reactions of inorganic and organic compounds in aqueous solutions;	Written exams in a form of MCQ, MRQ tests, a choice of yes/no answers, matching answers, with open questions. Standardized oral exams focused on the evaluation of knowledge on the level of understanding, analysis, synthesis, problem solving. Written tests in a form of short essays, reports, short structured questions	WY, CA, CL
B.W10.	the structure of simple organic compounds that make up the macromolecules present in cells, the extracellular matrix and body fluids;	Written exams in a form of MCQ, MRQ tests, a choice of yes/no answers, matching answers, with open questions. Standardized oral exams focused on the evaluation of knowledge on the level of understanding, analysis, synthesis, problem solving. Written tests in a form of short essays, reports, short structured questions	WY, CA, CL

B.W11.	the structure of lipids and polysaccharides and their functions in cellular and extracellular structures;	Written exams in a form of MCQ, MRQ tests, a choice of yes/no answers, matching answers, with open questions. Standardized oral exams focused on the evaluation of knowledge on the level of understanding, analysis, synthesis, problem solving. Written tests in a form of short essays, reports, short structured questions	WY, CA, CL
B.W12.	the I-, II-, III- and IV-order structures of proteins and post-translational and functional modifications of proteins and their significance;	Written exams in a form of MCQ, MRQ tests, a choice of yes/no answers, matching answers, with open questions. Standardized oral exams focused on the evaluation of knowledge on the level of understanding, analysis, synthesis, problem solving. Written tests in a form of short essays, reports, short structured questions	WY, CA, CL
B.W13.	the function of nucleotides in the cell, the I- and II-order structures of DNA and RNA, and the structure of chromatin;	Written exams in a form of MCQ, MRQ tests, a choice of yes/no answers, matching answers, with open questions. Standardized oral exams focused on the evaluation of knowledge on the level of understanding, analysis, synthesis, problem solving. Written tests in a form of short essays, reports, short structured questions	WY, CA, CL
B.W14.	the functions of the human genome, transcriptome and proteome and the principal methods used to study them, the processes of DNA replication, repair and recombination, transcription and translation and the degradation of DNA, RNA and proteins, and the concepts of regulation of gene expression;	Written exams in a form of MCQ, MRQ tests, a choice of yes/no answers, matching answers, with open questions. Standardized oral exams focused on the evaluation of knowledge on the level of understanding, analysis, synthesis, problem solving. Written tests in a form of short essays, reports, short structured questions	WY, CA, CL
B.W15.	the basic catabolic and anabolic pathways, how they are regulated, and how they are influenced by genetic and environmental factors;	Written exams in a form of MCQ, MRQ tests, a choice of yes/no answers, matching answers, with open questions. Standardized oral exams focused on the evaluation of knowledge on the level of understanding, analysis, synthesis, problem solving. Written tests in a form of short essays, reports, short structured questions	WY, CA, CL
B.W16.	the metabolic profiles of key organs and systems;	Written exams in a form of MCQ, MRQ tests, a choice of yes/no answers, matching answers, with open questions. Standardized oral exams focused on the evaluation of knowledge on the level of understanding, analysis, synthesis, problem solving. Written tests in a form of short essays, reports, short structured questions	WY, CA, CL
B.W17.	the ways in which cells communicate with each other and with the extracellular matrix, and the pathways for transmitting signals within the cell, and examples of disruption of these processes leading to cancer and other diseases;	Written exams in a form of MCQ, MRQ tests, a choice of yes/no answers, matching answers, with open questions. Standardized oral exams focused on the evaluation of knowledge on the level of understanding, analysis, synthesis, problem solving. Written tests in a form of short essays, reports, short structured questions	WY, CA, CL

B.W18.	the processes: cell cycle, proliferation, differentiation and ageing of cells, apoptosis and necrosis and their significance for the functioning of an organism;	Written exams in a form of MCQ, MRQ tests, a choice of yes/no answers, matching answers, with open questions. Standardized oral exams focused on the evaluation of knowledge on the level of understanding, analysis, synthesis, problem solving. Written tests in a form of short essays, reports, short structured questions	WY, CA, CL
B.W20.	the basics of stimulation and conduction in the nervous system and higher nervous functions, as well as striated and smooth muscle physiology and blood functions;	Written exams in a form of MCQ, MRQ tests, a choice of yes/no answers, matching answers, with open questions. Standardized oral exams focused on the evaluation of knowledge on the level of understanding, analysis, synthesis, problem solving. Written tests in a form of short essays, reports, short structured questions	WY, CA, CL
B.W23.	the body's ageing mechanism;	Written exams in a form of MCQ, MRQ tests, a choice of yes/no answers, matching answers, with open questions. Standardized oral exams focused on the evaluation of knowledge on the level of understanding, analysis, synthesis, problem solving. Written tests in a form of short essays, reports, short structured questions	WY, CA, CL
B.W25.	the relationship between factors disturbing the equilibrium state of biological processes and physiological and pathophysiological changes;	Written exams in a form of MCQ, MRQ tests, a choice of yes/no answers, matching answers, with open questions. Standardized oral exams focused on the evaluation of knowledge on the level of understanding, analysis, synthesis, problem solving. Written tests in a form of short essays, reports, short structured questions	WY, CA, CL
B.W29.	the principles of scientific, observational and experimental research and in vitro studies for the development of medicine.	Written exams in a form of MCQ, MRQ tests, a choice of yes/no answers, matching answers, with open questions. Standardized oral exams focused on the evaluation of knowledge on the level of understanding, analysis, synthesis, problem solving. Written tests in a form of short essays, reports, short structured questions	WY, CA, CL
B.U3.	calculate the molar and percentage concentrations of compounds and the concentrations of substances in iso-osmotic, mono- and multi-component solutions;	Direct observation and evaluation of the student’s manual performance, his abilities to solve problems, and abilities to prepare and present presentations on the indicated scientific topics	CL
B.U4.	calculate the solubility of inorganic compounds, determine the chemical basis of the solubility or lack thereof of organic compounds and its practical significance for dietetics and therapeutics;	Direct observation and evaluation of the student’s manual performance, his abilities to solve problems, and abilities to prepare and present presentations on the indicated scientific topics	CL
B.U5.	determine the pH of a solution and the effect of changes in pH on inorganic and organic compounds;	Direct observation and evaluation of the student’s manual performance, his abilities to solve problems, and abilities to prepare and present presentations on the indicated scientific topics	CL
B.U6.	predict the direction of biochemical processes in relation to the energy state of cells;	Direct observation and evaluation of the student’s manual performance, his abilities to solve problems, and abilities to prepare and present presentations on the indicated scientific topics	CL

B.U8.	use basic laboratory techniques such as qualitative analysis, titration, colorimetry, pH monitoring, chromatography, electrophoresis of proteins and nucleic acids;	Direct observation and evaluation of the student’s manual performance, his abilities to solve problems, and abilities to prepare and present presentations on the indicated scientific topics	CL
B.U9.	operate simple measuring instruments and assess the accuracy of the taken measurements;	Direct observation and evaluation of the student’s manual performance, his abilities to solve problems, and abilities to prepare and present presentations on the indicated scientific topics	CL
B.U10.	use databases, including online databases, and search for required information using the available tools;	Direct observation and evaluation of the student’s manual performance, his abilities to solve problems, and abilities to prepare and present presentations on the indicated scientific topics	CA
B.U13.	plan and carry out simple scientific research, interpret the results and draw conclusions from them.	Direct observation and evaluation of the student’s manual performance, his abilities to solve problems, and abilities to prepare and present presentations on the indicated scientific topics	CL
K.5	notice and recognise one's own limits and to self evaluate and identify educational deficits and needs	Direct observation of the student's researchactivity during practical laboratorydeterminations and his social communicationskills, including in a multicultural group.	CA, CL
K.7	use objective sources of information	Direct observation of the student's researchactivity during practical laboratorydeterminations and his social communicationskills, including in a multicultural group.	CA
K.8	formulate conclusions based on own measurements or observations	Direct observation of the student's researchactivity during practical laboratorydeterminations and his social communicationskills, including in a multicultural group.	CA, CL
Lectures (L); Seminars (SE); Auditorium classes (AC); Major Classes - not clinical (MC); Clinical Classes (CC); Laboratory Classes (LC); Classes in Simulated Conditions (CSC); Practical Classes with Patient (PCP); Foreign language Course (FLC), Physical Education (PE); Vocational Practice (VP); Directed Self-Study (DSS), E-learning (EL)			

Student's amount of work **(balance of ECTS points):**	
Student's workload (class participation, activity, preparation, etc.)	**Student Workload**
1. Number of hours of direct contact:	50
2. Number of hours of distance learning:	10
3. Number of hours of student's own work:	82
4. Number of hours of directed self-study	0
Total student's workload:	142
ECTS points for course:	6

Content of classes: (please enter topic words of specific classes divided into their didactic form and remember how it is translated to intended educational effects

Lectures:

1. Energetics of the cell, biological oxidation and oxidative stress – part 1 2. Energetics of the cell, biological oxidation and oxidative stress – part 2 3. Metabolic profile of the liver and metabolism of iron – part 1 4. Metabolic profile of the liver and metabolism of iron – part 2 5. Metabolic profile of the alimentary system. Metabolic adaptation to varying conditions of the organism. 6. Metabolic profiles of the heart and brain. 7. Metabolic profile of the blood cells – part 1 8. Metabolic profile of the blood cells – part 2. Biochemistry of the inflammatory state. 9. Metabolic reprogramming of cancer cells – part 1 10. Metabolic reprogramming of cancer cells – part 2

Seminars:

1. The Krebs cycle and its biomedical significance. Complexes of respiratory chain and disturbances in its function. 2. Glycerol-3-phosphate and malate-aspartate shuttle. Substrate and oxidative phosphorylation - mechanisms. ATP synthesis. 3. Bone metabolism. Calcium metabolism and its disorders. Phosphorus metabolism and its disorders. Metabolism of ,,vitamin". D. 4. Metabolic profile of skeletal muscles. Structure and function of the extracellular matrix. 5. Metabolic profile of the kidney. The renin-angiodensin-aldosterone system. 6. Pulmonary metabolic profile: first-pass metabolism, role of pulmonary surfactant, gas exchange, anaphylaxis. 7. Eicosanoid metabolism. COX. Acute phase proteins. 8. Erythrocyte metabolic profile. Haemoglobin metabolism. 9. Coagulation cascade. Inhibitors of the clotting process. Fibrinolysis. Complement system. 10. Integration of metabolism.

Classes::

1. Analysis of oxidative stress parameters - part 1. 2. Analysis of oxidative stress parameters - part 2. Isolation and determination of DNA. 3. TEST I. Determination of creatinine and bilirubin. 4. Determination of ethanol and delta-aminolevulinic acid concentrations in biological material. Protein denaturation with ethanol (toxicity of ethanol). 5. Examination of cathepsins activity in biological material. 6. TEST II. Examination of digestive enzymes activity: trypsin, amylase and pancreatin. 7. Preparation and analysis of hemoglobin spectrum. Determination of iron in biological material. Electrophoretic analysis of haptoglobin. 8. Determination of osmotic resistance of red blood cells. Determination of calcium in biological material. 9. TEST III. Immunodetection (blotting and dotting). 10. Second term of tests I, II and III. Determination of urea.

Other:

Consultations

Basic literature

Richard A. Harvey et al. “Lippincot’s Illustrated Reviews: Biochemistry” VIII Edition, 2021; ISBN-13: 978-1975155063 ; ISBN-10: 1975155068

Additional literature and other materials:

1. Robert K. Murray et al. "Harper's Biochemistry"31st edition; 2018; ISBN10 1259837939l; ISBN13 9781259837937 2. Thomas M. Devlin „Biochemistry with Clinical Correlations”, 7th edition; Willey-Liss, New York; ISBN: 978-0-470-28173-4 3. L. Baynes., M. Dominiczak, „Medical Biochemistry”, Mosby Elsevier, 5th Edition, 2018; ISBN: 9780702072994 ; eBook ISBN: 9780702073007

Preliminary conditions:

The student should know the fundamentals of chemistry and biology at the high school level and obtain a credit from first and second semester of biochemistry with elements of chemistry.

Rules for granting partial grades in the subject during the semester:

Obtaining positive grades from all tests scheduled in a course (3 tests in a semester) conducted either in written or oral form and encompassing designated material covered during lectures, seminars and laboratories as well as based on student's own work from the specified literature. Only the answers from those indicated sources will be considered as the correct ones. To get a credit for a test a Student needs to obtain at least 60% of possible to obtain points, with the reservation, that the criteria for obtaining a credit for a particular test can change (exclusively in favor of Students) after the analysis of the degree of difficulty of a given test. The tests are composed of test questions part (MCQ, MRQ tests) and open questions part that requires completing a task, for example, writing/completing the reaction, diagram, table, graph, description of a mechanism of action, giving examples or traits, calculating the values, etc. Additionally these partial tests will contain 1-2 additional questions from the detailed knowledge, points obtained from these questions will be added to the points of the test, enabling a Student to get >100% of points, with the reservation that the maximal number of points possible to obtain cannot exceed 10% of the maximal number of test points. In a case when a Student will not get a credit for a given section it is required to retake the test at the indicated date. Retake of the test can be in the written or oral form depending on the number of Students. The final grade from a given test is an average of points obtained in all the terms. The tests are conducted in the direct contact with teacher. In exceptional situations, by the decision of the University Authorities, they can be conducted in a remote form.

Conditions to receive credit for the course:

1. Proper completing of laboratory classes and preparation of reports summarizing the obtained data, containing correct calculations and conclusions from the conducted experiments. 2. Active participation in seminar classes – analyzing and solving scientific problems and involvement in preparation of scientific presentations and active participation in discussion. Students activity during the seminars is evaluated in a scale from 0 to 10 points. 3. Each absence on laboratory as well as seminar classes must be made up by a Student in a manner indicated by a person supervising the classes in agreement with a person responsible for the subject. 4. Semestral grade for the subject is based on the sum of points obtained by a Student from the tests conducted in a given semester and points obtained from seminars expressed as a percentage of maximal number of points possible to obtain in a given semester and calculated according to the criteria for obtaining particular grades presented in a Table below. To promote among the Students a systematic studying, the points obtained during final exam in the subject will be augmented by additional points, calculated on the basis of semestral grades and reflecting a systematic work of a Student during the whole course of Biochemistry with elements of chemistry, according to the criteria listed in the point concerning the final Exam: • Semestral grade: very good (5.0) – 5% of the points possible to obtain during final exam; • Semestral grade: above good (4.5) – 4.5% of the points possible to obtain during final exam; • Semestral grade: good (4.0) – 4% of the points possible to obtain during final exam. Percent points obtained for each semester are summed up, enabling a Student to get additional points amounting to up to 15% of maximal number of final exam points. The Students who from all tests obtained ≥100% of maximal to obtain points (counting also additional points) are exempted from final exam with a grade of 5.0. Both additional points as well as exemption from the final exam are granted exclusively to Students who passed all the tests on the first term.

Grade	**Criteria for courses ending with a grade**
Very Good (5.0)	≥ 93% of maximal number of points obtained from the tests
Good Above (4.5)	≥ 85% of maximal number of points obtained from the tests
Good (4.0)	≥ 77% of maximal number of points obtained from the tests
Satisfactory Plus (3.5)	≥ 69% of maximal number of points obtained from the tests
Satisfactory (3.0)	≥ 60%of maximal number of points obtained from the tests
Criteria for courses ending with a credit (without a grade)	
Credit	
Grade	**Criteria for exam**
Very Good (5.0)	≥ 93% of maximal number of points obtained from the tests
Good Above (4.5)	≥ 85% of maximal number of points obtained from the tests

Good (4.0)	≥ 77% of maximal number of points obtained from the tests
Satisfactory Plus (3.5)	≥ 69% of maximal number of points obtained from the tests
Satisfactory (3.0)	≥ 60%of maximal number of points obtained from the tests

Department in charge of the course:	Katedra Biochemii i Immunochemii
Head of Department in charge of the course:	Prof. dr hab. Małgorzata Krzystek-Korpacka
Telephone:	71 784 13 70, 784 13 71
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CONSULTATION: Detailed information pertaining to the dates and places for consultation of academic staff are provided on the university websites of the departments in which the given subjects are being conducted. Additionally the information is posted next to the department secretary.

Date of syllabus preparation
2023-10-06