

1.	Subject	<b>BIOCHEMISTRY</b>			
2.	Code	MLD – 121			
3.	Study program:	Three-year professional studies of medical laboratory diagnostics			
4.	Conducted by	UKIM Medical Faculty – Skopje Department of Biochemistry and Clinical Biochemistry			
5.	Degree of education (first or second cycle)	First cycle			
6.	Academic year/semester	First/II	7.	Credits	7.5
8.	Professor	Head of the Department: Prof. d-r Jasna Bogdanska The lessons are held by all the Department members			
9.	Prerequisite	Signature in Chemistry			
10.	Goals	<p>The main goal of the subject program after the lessons and the exams is for the students to gain basic knowledge of biomolecules, their characteristics and their participation in the cell and organ structure in the human organism, as well as the metabolic processes in a healthy human. The gain knowledge will be the basis for understanding basic molecular processes inside the cell, as well as pathological processes.</p> <p><i>Knowledge and understanding:</i> After the subject program the students:</p> <ul style="list-style-type: none"> <li>• Will be able to classify biomolecules that are part of the organism;</li> <li>• Will know to define simple and complex biomolecules and explain their role in the metabolism;</li> <li>• Will know to explain the differences and similarities between hemoglobin and myoglobin;</li> <li>• Will be able to explain the structure and role of DNA in the organism;</li> <li>• Will know to explain enzyme kinetics and classify enzymes and their role in creation;</li> <li>• Will be able to explain the cycles related to metabolism of proteins, carbohydrates and lipids;</li> <li>• Will know to explain the regulation of the basic metabolic cycles;</li> <li>• Will know to calculate the energy contribution of the metabolism of carbohydrates and lipids;</li> <li>• Will be able to explain glucose homeostasis</li> <li>• Will be able to define the term free radicals, oxidative stress and name their role in some pathological conditions and diseases;</li> <li>• Will know to search for literate biochemistry data;</li> <li>• Will present personal laboratory results; gathered literate medical biochemistry data in written and oral form;</li> <li>• Will be able to defend, develop and analyze personal and presented results of colleges and connect them with particular pathological conditions and diseases;</li> <li>• Will respect ethical and safety rules of biochemistry;</li> </ul> <p><i>Skills and knowledge:</i> After finishing the lessons the students will be able to:</p> <ul style="list-style-type: none"> <li>• Connect the theoretical knowledge with the biochemical bases of the physiological functions of particular organs and systems, as well as the</li> </ul>			

		<p>biochemical bases of particular metabolic conditions.</p> <p><i>Ability to evaluate and form opinions</i></p> <p>After finishing the lessons the students will be able to:</p> <ul style="list-style-type: none"> <li>• To implement analysis principle in their learning.</li> </ul>
11.	<p>Content summary:</p> <p><b>Theoretical lessons:</b></p> <ul style="list-style-type: none"> <li>• Foundations of biochemistry; Cell biochemistry and subcellular organelles, metabolic processes of the cell;</li> <li>• Protein structure and function, the role of proteins in the nutrition, essential amino acids, Remodeling of amino acids; compounds that come from amino acids: hemoglobin – as allosteric protein, sickle cell anemia; myoglobin as a source and intracellular transporter of oxygen;</li> <li>• Nucleic acids, structure, function, the role in the transport of genetic material, biosynthesis of proteins, regulation of genes expression;</li> <li>• Carbohydrates – monosaccharides, oligosaccharides and polysaccharides;</li> <li>• Lipids – fatty acids, complex fats, phospholipids, sterols;</li> <li>• Biological membranes and transport;</li> <li>• Enzymes – chemical-biochemical structure of enzymes, Mechanism of enzyme catalysis; Inhibition of enzyme activity; Classification of enzymes;</li> <li>• General overview of metabolism, anabolism, catabolism;</li> <li>• Reabsorption and transport of amino acids; Digestion of proteins, urea cycle, biosynthesis of non-essential amino acids;</li> <li>• Metabolism of carbohydrates, reabsorption and digestion, catabolism of glucose, biosynthesis of glycogen, glycogen decomposition, anaerobic decomposition of glucose, alanine cycle, glyconeogenesis, pentose phosphate pathway; Regulation of blood glucose levels; metabolism of fructose and galactose;</li> <li>• Metabolism of fats, metabolism of triacilglycerols in the digestive tract, lipase, gall bladder acids, catabolism and biosynthesis of triacilglycerols and fatty acids; Lipoproteins;</li> <li>• Citric acid cycle; catabolism of acetyl – ScoA;</li> <li>• Energy aspects of metabolism – Respiratory chain, oxidative phosphorylation and biosynthesis of ATP;</li> <li>• Biosynthesis and decomposition of hemoglobin;</li> <li>• Metabolism of purine and pyrimidine</li> </ul> <p><b>Seminars:</b></p> <p>Experimental methods in biochemical research; Coenzymes – prosthetic groups and cosubstrates and their role in enzyme catalysis, interactions with the substrate; Coenzymes as transport systems of hydrogen and groups;</p> <p>Micronutrients; hormones and endocrine system; characteristic of the hormonal system, structure and function of hormones, activity mechanism of hormones, hormone regulation, tissue hormones – gut hormones;</p> <p>Cholesterol metabolism; connection of the metabolism of carbohydrates, fats and proteins, citric acid cycle, metabolism of water and electrolyte;</p> <p>Free radicals and oxidative stress; Metabolism of xenobiotics; metabolism of adipose, muscular tissue and liver; porphyrin and porphyria</p>	
12.	<p>Teaching methods</p> <p><b>Theoretical lessons and seminars:</b></p> <p>Theoretical lessons and seminars (mandatory attendance); oriented individual learning at home, consultations; monitoring the gained knowledge and skills.</p>	

	<p>The students must go through the material which will be used in the seminars.</p> <p><b>Seminars/Laboratory exercises</b></p> <p>The seminars/practical lessons are according to particular chapters of the theoretical lessons.</p> <p><b>Activities of the student:</b></p> <p>Attending the theoretical lessons, exercising skills through individual laboratory work, homework assignments, writing a paper, presenting the paper or part of the subject program.</p>		
13.	Total classes:	90	
14.	Organization		
15.	Types of teaching activities	15.1	Lessons: theoretical classes 45
		15.2	Seminars/laboratory exercises 15
16.	Other types of activities	16.1	Practice 30
		16.2	Self-supporting practice
		16.3	Learning at home
17.	Knowledge assessment		Points
	17.1	Tests	(Written) test points 12-20 min.-max. <b>1. Introduction to medicine/health education:</b> Points 15-20 <b>2. Andragogy/Pedagogy/Didactics</b> Points 15-20
	17.2	Paper/project (oral/written presentation) Practical lessons	4-7 points
	17.3	1.Final exam: Oral/written exam (condition, pass the test from the theoretical lessons)	1.24-40 points min.-max.
		2.Seminars' test	2. 9-15 points min.-max.
17.3	Active participation	Min. – max. Theoretical lessons 1 - 3 Practical lessons*/Seminars 9 - 15 The student can miss 2 practical lessons.	
18.	Grading criterion (points/grades)	Up to 59 points	5 (five) F
		From 60 to 68 points	6 (six) E
		From 69 to 76 points	7 (seven) D
		From 77 to 84 points	8 (eight) C
		From 85 to 92 points	9 (nine) B
		From 93 to 100 points	10 (ten) A
19.	Requirements for obtaining a signature and attending the	The student must obtain minimum points of attending the theoretical lessons and the seminars. To attend the final exam, the student must pass the test. The final grade for the subject is formed according to the table for grading, and is	

	final examination	based on the sum of the points from all the activities.	
20.	Language	Macedonian/English	
21.	Method of evaluating the quality of the lessons	Student anonymous evaluation of the subject, the professors and collaborators who participate in the lessons.	
22.	Literature		
	22.1	Mandatory literature	
		1.	Sloboda Dzekova – Stojkova et al., Biochemistry, Medical Faculty, UKIM, Skopje, 2010
		2.	
	22.2	Additional literature	
	1.	Biochemistry exercises practicum	