<table>
<tr><td>1.</td><td>Subject</td><td colspan="4">GENERAL CLINICAL CHEMISTRY</td></tr>
<tr><td>2.</td><td>Code</td><td colspan="4">MLD – 211</td></tr>
<tr><td>3.</td><td>Study program:</td><td colspan="4">Three-year professional studies of medical laboratory diagnostics</td></tr>
<tr><td>4.</td><td>Conducted by</td><td colspan="4">UKIM Medical Faculty – Skopje
Department of Medical Chemistry</td></tr>
<tr><td>5.</td><td>Degree of education (first or second cycle)</td><td colspan="4">First cycle</td></tr>
<tr><td>6.</td><td>Academic year/semester</td><td>Second/III and IV</td><td>7.</td><td>Credits</td><td>5.5 III semester
3 IV semester</td></tr>
<tr><td>8.</td><td>Professor</td><td colspan="4">Head of the Department Prof. d-r Marija Krstevska
All the professors of the Department of Medical Chemistry and Biochemistry with Clinical Biochemistry</td></tr>
<tr><td>9.</td><td>Prerequisite</td><td colspan="4">Passed exam in Chemistry</td></tr>
<tr><td>10.</td><td>Goals</td><td colspan="4">• Prepare reagents for laboratory analyses
• Do chemical, morphologic and standard analysis of urine, as well as analysis of urine with the method of flow cytometry
• Determine activity of CK, alpha-amylase, alkaline phosphatase, GGT, isoenzymes and CK MB and LDH
• Determine the concentration of glucose, bilirubin and iron
• Determine the concentration of proteins, electrolytes, elements in traces
• Use methods for determining lipids, HDL, LDL and VLDL lipoprotein
• Use the techniques for separating proteins, proteins in urine as part of the procedure for diagnosing kidney problems
• Get acquainted with different organization models of a medical biochemistry laboratory and intra-laboratory organization of work according to the specific problematic that is considered.
• Participate in calibration and quality control
• Make comparison of results with reference ranges
• Master the basic methodology of tests for assessing the metabolism of carbohydrates, proteins, lipids and their diagnostic importance
• Do measurement of the gas concentration in different clinical conditions
• Notice organization problems in the laboratory work
• Recognize pre-analytical and post-analytical mistakes and how, with proper use of the regulations for good laboratory practice, to avoid them</td></tr>
<tr><td>11.</td><td colspan="5">Content summary:
Theoretical lessons:
Introduction to clinical biochemistry: history and development of the field. Pre-analytical phase. Analytical procedures in clinical biochemistry. Biologic material. Standard urine analysis: chemical, morphologic and with the method of flow cytometry. Introduction to enzymes, isoenzymes. Enzymes and isoenzymes as indicators to liver problems. Creatine kinase and isoenzymes of CK in the diagnosis of myocardial infarction. The difference in activity of enzymes and determining the enzyme mass. Isoenzymes and enzymes specific for pancreatic disorders. Non-protein nitrogen compounds: creatinine, uric acid, creatinine clearance. Carbohydrates, glucose, lactose, galactose. Strain tests in case of diabetes diagnosis. Bilirubin, bile acids and colors. Hemoglobin. Iron and biologically important inorganic compounds. Proteins and iron transporters. Electrolytes. Elements</td></tr>
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	in traces. Lipids: cholesterol, triglycerides, fatty acids. Lipoproteins: structure and methods of determining HDL, LDL and VLDL lipoproteins, apoproteins. Risky and desired ranges of lipids and lipoproteins. Introduction to proteins. Protein separation techniques. Immunochemical methods. Immunochemical methods with marked Ag/At. Proteins in urine – algorithm for diagnosing kidney problems. Classification of laboratories according to level of health protection and proper analyses. Needed equipment, complementing services. Medical biochemistry laboratory at the level of primary health care institution (preparing a urgent laboratory results compared to regular work). Specialized laboratory, the employees in clinical laboratories. Interpretation of the results. The responsibility of the medical personnel in the process of laboratory analysis. Integration of the laboratory as part of different health organizations. Consolidation. **Practical lessons:** • Reagents preparation. • Qualitative urine analysis. • Determining calcium, nonorganic phosphorus, magnesium, copper, iron, bilirubin, total proteins, urea, uric acid, creatinine, glucose, cholesterol, triglycerides, phospholipids, HDL and LDL cholesterol. • Electrophoretic separation of serum proteins and lipoproteins. • Determining the activity of alpha-amylase, alkaline phosphatase, GGT, ALT/AST, total activity of creatinine kinase and isoenzymes CK MB, LDH, alpha-HBDH.				
12.	Teaching methods: Clinical type of theoretical and practical lessons, check of knowledge and skills is regular. The points are according to the ECTS with a proper explanation.				
13.	Total classes:		130		
14.	Organization				
15.	Types of teaching activities		15.1	Lessons: theoretical classes	15 – III semester 15 – IV semester
			15.2	Practical lessons, seminars, team work	practical lessons: 30 – III semester 30 – IV semester Practice: 40 – III semester
16.	Other types of activities		16.1	Practice	
			16.2	Self-supporting practice	
			16.3	Learning at home	180
17.	Knowledge assessment		Points		
	17.1	Tests	Mid-term exams Points 12-20 **Mid-term exams** 2 tests in writing (10 and 10 points) total 20 points		
	17.2	1.Final exam:	**Oral exam** Theoretical part points 1 – 3 (min.-max.) Practical part points 23 – 39 Do one exercise independently		
	17.3	Active participation	Min. – max. Theoretical lessons 1 - 3 51-60% - 1 point 61-85% - 2 points		

			86-100% - 3 points Practical lessons 12 - 18 12 practical lessons: attendance 0.5 points + 1 point participation
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 final examination	At least 1 point from attending the theoretical lessons and at least 12 points from the practical lessons	
20.	Language	Macedonian	
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.	Straus B., Medical Biochemistry, Medicinska naknada, Zagreb. 1992
		2.	Topikj E., Primorac D. and Stipan Jankovikj, Medical biochemistry diagnostic in clinical practice, Medicinska naknada, Zagreb, 2004
	22.2	Additional literature	