

1.	Subject	<b>INSTRUMENTAL METHODS IN CLINICAL BIOCHEMISTRY</b>			
2.	Code	MLD – 214			
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	Second/III	7.	Credits	4
8.	Professor	Head of the Department: prof. d-r Jasna Bogdanska The lessons are held by all the Department members			
9.	Prerequisite				
10.	Goals	<p>The main goal of the subject program is after finishing the lessons and passing the exam, the students to gain basic knowledge of the physical and chemical methods that are used in clinical biochemistry and through practical work to gain the necessary skills to use instrumental methods. It is also the aim for the students to get acquainted with the newest and most contemporary achievements and possibilities in laboratory analytics.</p> <p><i>Knowledge and understanding:</i> After finishing the subject program the students will be able to:</p> <ul style="list-style-type: none"> <li>• Explain the use of the method spectrophotometry, nephelometry and turbidimetry</li> <li>• Explain the principle of working with spectrophotometer</li> <li>• List the theoretical foundations of ion-selective electrodes, colorimetric and potentiometric detecting of pH;</li> <li>• Define the basic principles of the methods of chromatography and electrophoresis</li> <li>• Compare general characteristics of anion and cation exchangers</li> <li>• Argue the use of DNA analysis in forensic- medical laboratories</li> <li>• Search for literate data from the field of use of physical and chemical methods in clinical laboratory</li> <li>• Present personal laboratory results in written and oral form</li> <li>• Defend, develop and analyze their personal findings</li> <li>• Respect the ethical and safety rules in work</li> </ul> <p><i>Skills and knowledge:</i> After finishing the subject Instrumental Methods in Clinical Biochemistry, the students will be able to:</p> <ul style="list-style-type: none"> <li>• Link the theoretical knowledge with practical work, through which they will gain skills for using the instrumental methods and get acquainted with the newest and most contemporary achievements and possibilities and their use in laboratory analytics.</li> </ul> <p><i>Ability to assess and give opinion</i> After finishing the subject Instrumental Methods in Clinical Biochemistry the students will be able to:</p> <ul style="list-style-type: none"> <li>• Implement the analysis principles in their learning process</li> </ul>			

11.	<p>Content summary:</p> <p><b>Theoretical lessons:</b></p> <ul style="list-style-type: none"> <li>• Spectrophotometry (UV, VIS), laws for light absorption, spectral photometry, work principles of spectral photometry, inside and outside photo-effect, radiation receptors, displaying the results.</li> <li>• Laws of emission analysis: nephelometry and turbidimetry; Optical methods of measuring blurriness of colloid systems</li> <li>• Mass spectrometry – theoretical bases; working principles of mass spectrometer, fatty acids specter</li> <li>• Refractometry and polarimetry; laws of light diffraction, refractometry equipment. Basic principles of light polarization, parts of a polarimeter, polarimetric analyses.</li> <li>• Fluorometry – theoretical bases of fluorescence and phosphorescence, physical principles and fluorescence, spectrofluorometers, working principle</li> <li>• Theoretical bases of flame photometry and atomic absorption spectrophotometry</li> <li>• Theoretical bases for determining pH, potentiometric detecting of pH</li> <li>• Ion-selective electrodes – membrane potential</li> <li>• Theory of ion exchangers and their structure; basic characteristics of cation and anion exchangers.</li> <li>• Chromatography – theoretical bases of absorption and distribution chromatography; examples of chromatography of a column, gas chromatography, distribution chromatography, HPLC</li> <li>• Electrophoresis – theoretical bases, electrophoresis of celogen, gel electrophoresis, electrofocus and immunoelectrophoresis</li> <li>• Chemiluminescence and bioluminescence, theory of using analytical chemistry</li> <li>• Foundations of instrumental analytics in molecular biology</li> <li>• Autoimmunization in clinical biochemistry, discontinuing and continuing devices for automatic analysis</li> </ul>			
12.	<p>Teaching methods:</p> <p><b>Theoretical and practical lessons:</b> Theoretical and practical laboratory lessons (mandatory attendance); oriented individual learning at home, consultation; monitoring of the gained knowledge and skills. The students must go through the material before the practical lessons</p> <p><b>Student activities:</b> Attending the theoretical lessons, practicing skills through individual laboratory work, homework assignments</p>			
13.	Total classes: 115			
14.	Organization			
15.	Types of teaching activities	15.1	Lessons: theoretical classes	15
		15.2	Practical lessons, seminars, team work	45
16.	Other types of activities	16.1	Practice	
		16.2	Self-supporting practice	
		16.3	Learning at home	55
17.	Knowledge assessment	Points		

	17.1	1.Final exam:	<b>Oral exam</b> Theoretical part points 18 – 30 (min.-max.) Practical part points 30 – 50 Do one exercise independently
	17.3	Active participation	Min. – max.  Theoretical lessons 1 - 5  Practical lessons 9 - 15  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	To obtain a signature, the student must gain minimum points from visiting the theoretical lessons and 100% attendance and active participation in the practical lessons.  The final grade for the subject is formed according to the table for grading, and is 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.	Instrumental analysis, Aleksandar Veljanovski, University Ss. Cyril and Methodius, Skopje, 1994
	22.2	Additional literature	
	1.	Practicum for exercises in instrumental analyses	