



**INTEGRATED ACADEMIC  
STUDIES  
OF MEDICINE**

**FIRST YEAR**

2023/2024.

**MEDICAL CHEMISTRY**

## **MEDICAL CHEMISTRY**

ECTS 3. There are 3 hours of active classes per week (2 hours of lectures and 1 hour of work in a small group).

## TEACHERS

PB	Name and surname	E-mail address	Academic title
1.	Prof. Dr. Nedeljko Manojlović	mtnedeljko@gmail.com	Full professor
2.	Prof. Dr Ratomir Jelic	rjelic@kg.ac.rs	Full professor
3.	Dr. Jovica Tomović	jovicatomovic2011@gmail.com	Assistant professor

## MEDICAL CHEMISTRY

Module	Module content	week	lectures	work in a small group	Teacher Head of the module
1	<p>Introduction to Medical chemistry. The importance of chemistry as a science. General chemistry. Basic chemical terms. Chemical laws. Chemical bonds. Types of chemical compounds. Solutions. Chemical Analysis. Kinetics and Equilibrium. Acidity of solutions. pH value. Redox reactions.</p> <p>Inorganic chemistry and chemistry of bioelements. Properties of elements of the main groups of the periodic system of elements. Inorganic compounds. Acids, bases and salts. Chemical reactions. Dispersion systems. Solubility. Concentration of the solution. Electrolytes. Diffusion. Dialysis. Osmosis. Buffers. Biogenic elements, macro and microelements.</p> <p>Organic chemistry. Functional groups. Chemical reactions of organic molecules. Organic compounds. Aliphatic and aromatic organic compounds. Aldehydes. Ketones. Heterocyclic Compounds. Organic compounds with nitrogen and organic compounds with sulfur. Primary biomolecules and their role and importance. Amino acids. Peptides. Proteins. Structure. Carbohydrates. Monosaccharides. Disaccharides and polysaccharides. Lipids. Alkaloids. Instrumental methods in medicine.</p>	5	6	3	Prof. dr Nedeljko Manojlović
					$\Sigma 30+15=45$

## GRADING SYSTEM:

The grade is equivalent to the number of points earned (see tables). Points are earned in two ways:

**ACTIVITY DURING THE LESSON:** In this way, the student can earn up to 30 points in total. By doing the practical part, he can achieve up to 10 points. Also, the student takes two colloquiums where he can get up to 20 points, which include theoretical questions, questions from practical classes and assignments.

**FINAL EXAM:** The final exam is taken as an oral exam.

MODULE		MAXIMUM POINTS		
		activity during classes	final exam	Σ
1	Introduction to Medical chemistry. The importance of chemistry as a science. General chemistry. Basic chemical terms. Chemical laws. Chemical bonds. Types of chemical compounds. Solutions. Chemical Analysis. Kinetics and Equilibrium. Acidity of solutions. pH value. Redox reactions. Inorganic chemistry and chemistry of bioelements. Properties of elements of the main groups of the periodic system of elements. Inorganic compounds. Acids, bases and salts. Chemical reactions. Dispersion systems. Solubility. Concentration of the solution. Electrolytes. Diffusion. Dialysis. Osmosis. Buffers. Biogenic elements, macro and microelements. Organic chemistry. Functional groups. Chemical reactions of organic molecules. Organic compounds. Aliphatic and aromatic organic compounds. Aldehydes. Ketones. Heterocyclic Compounds. Organic compounds with nitrogen and organic compounds with sulfur. Primary biomolecules and their role and importance. Amino acids. Peptides. Proteins. Structure. Carbohydrates. Monosaccharides. Disaccharides and polysaccharides. Lipids. Alkaloids. Instrumental methods in medicine.	30	70	100
	Σ	30	70	100

### The final grade is formed as follows:

In order to pass the course, the student must obtain a minimum of 51 points and pass the module.

The final grade is formed on the basis of the number of points that can be gained on the following ways:

1. Pre-exam activities – Pre-exam activities are evaluated through activity in practical classes (10 points) and two colloquiums (2x10 = 20 points). In each of the pre-exam activities, the student must achieve more than 50 percent.
2. Final exam – The final exam is organized as an oral exam and includes a check of knowledge from the overall material covered during class. In the oral exam, the student can achieve a maximum of 70 points.

The method of evaluation based on the points obtained is shown in the following table:

<b>NUMBER OF POINTS ACHIEVED</b>	<b>GRADE</b>
0 - 50	<b>5</b>
51 – 60	<b>6</b>
61 – 70	<b>7</b>
71 – 80	<b>8</b>
81 – 90	<b>9</b>
91 - 100	<b>10</b>

# **FINAL GRADE**

## **MODULE**

**ACTIVITY AT  
EXERCISES  
0-10 POINT**

**2 COLLOQUIUMS  
0-20 POINT**

**FINAL EXAM  
0-70 POINTS**

## LITERATURE:

MODULE	TITLE OF THE TEXTBOOK	THE AUTHORS	PUBLISHER	LIBRARY
Introduction to Medical chemistry. The importance of chemistry as a science. General chemistry. Basic chemical terms. Chemical laws. Chemical bonds. Types of chemical compounds. Solutions. Chemical Analysis. Kinetics and Equilibrium. Acidity of solutions. pH value. Redox reactions. Inorganic chemistry and chemistry of bioelements. Properties of elements of the main groups of the periodic system of elements. Inorganic compounds. Acids, bases and salts. Chemical reactions. Dispersion systems. Solubility. Concentration of the solution. Electrolytes. Diffusion. Dialysis. Osmosis. Buffers. Biogenic elements, macro and microelements.	Bioinorganic Chemistry: Inorganic elements in the Chemistry of Life: An Introduction and Guide.	Kaim W, Schwederski B, Klein A.	Chichester, West Sussex, United Kingdom: Wiley; 2006.	Yes
Organic chemistry. Functional groups. Chemical reactions of organic molecules. Organic compounds. Aliphatic and aromatic organic compounds. Aldehydes. Ketones. Heterocyclic Compounds. Organic compounds with nitrogen and organic compounds with sulfur. Primary biomolecules and their role and importance. Amino acids. Peptides. Proteins. Structure. Carbohydrates. Monosaccharides. Disaccharides and polysaccharides. Lipids. Alkaloids. Instrumental methods in medicine.	Fundamentals of General, Organic, and Biological Chemistry. 7th edition.	McMurry JE, Ballantine DS, Hoeger CA, Peterson VE.	Boston: Pearson; 2012.	Yes

**All lectures and material for small group work are available on the website of the Faculty of Medical Sciences: [www.medf.kg.ac.rs](http://www.medf.kg.ac.rs)**

# COURSE UNIT CONTENTS

## MODULE: GENERAL AND INORGANIC CHEMISTRY, CHEMISTRY OF BIOELEMENTS AND ORGANIC CHEMISTRY

### UNIT 1 (FIRST WEEK):

#### BASIC CHEMICAL TERMS

lectures 2 hours	Small group work 1 hour
The importance of chemistry as a natural science Basic chemical terms. Basic chemical laws	Basic chemical terms

### UNIT 2 (FIRST WEEK):

#### CHEMICAL BONDS

lectures 2 hours	Small group work 1 hour
Ionic bond Covalent bond Intermolecular forces	Ionic bond Covalent bond Intermolecular forces

### UNIT 3 (FIRST WEEK):

#### SOLUTIONS. CHEMICAL REACTIONS

lectures 2 hours	Small group work 1 hour
Solution Concentration Chemical reactions	Preparation of the solution Calculation of concentration

### UNIT 4 (SECOND WEEK):

#### INORGANIC COMPOUNDS. ACIDS, BASES AND SALTS. BUFFERS

lectures 2 hours	Small group work 1 hour
Acids, bases and salts. pH value. Buffers	Acidity. Calculation of pH values. Buffers

### UNIT 5 (SECOND WEEK):

#### PERIODIC TABLE OF ELEMENTS

lectures 2 hours	Small group work 1 hour
Periodic Table of Elements Elements of the 1st, 2nd and 14th groups and their compounds	Periodic Table of Elements Elements of the 1st, 2nd and 14th groups and their compounds

### UNIT 6 (SECOND WEEK):

#### PERIODIC TABLE OF ELEMENTS

lectures 2 hours	Small group work 1 hour
Elements of the 15th, 16th and 17th groups and their compounds	Elements of the 15th, 16th and 17th groups and their compounds

## UNIT 7 (THIRD WEEK):

**ORGANIC CHEMISTRY. CLASSIFICATION OF ORGANIC COMPOUNDS**

lectures 2 hours	Small group work 1 hour
Halogen elements Organic chemistry. Functional group Alkanes, alkenes, alkynes and dienes Aromatic compounds	Functional group Alkanes, alkenes, alkynes and dienes Aromatic compounds

## UNIT 8 (THIRD WEEK):

**ORGANIC OXYGEN COMPOUNDS AND ALKYL HALIDES**

lectures 2 hours	Small group work 1 hour
Alkyl halides Alcohols, ethers, epoxides and phenols	Alkyl halides Alcohols, ethers, epoxides and phenols

## UNIT 9 (THIRD WEEK):

**CARBONYL COMPOUNDS. ALDEHYDES AND KETONES**

lectures 2 hours	Small group work 1 hour
Aldehydes and ketones	Aldehydes and ketones

## UNIT 10 (FOURTH WEEK):

**CARBOXYLIC ACIDS. ESTERS. ORGANIC SULFUR COMPOUNDS. ORGANIC NITROGEN COMPOUNDS**

lectures 2 hours	Small group work 1 hour
Carboxylic acids and functional derivatives Esters Organic sulfur compounds Organic nitrogen compounds	Carboxylic acids and functional derivatives Esters Organic sulfur compounds Organic nitrogen compounds

## UNIT 11 (FOURTH WEEK):

**HETEROCYCLIC COMPOUNDS. AMINO ACIDS, PEPTIDES AND PROTEINS**

lectures 2 hours	Small group work 1 hour
Heterocyclic compounds Amino acids	Heterocyclic compounds Amino acids

## UNIT 12 (FOURTH WEEK):

**SECONDARY METABOLITES. ALKALOIDS**

lectures 2 hours	Small group work 1 hour
Secondary metabolites. Alkaloids	Secondary metabolites. Alkaloids

UNIT 13 (FIFTH WEEK):

**PEPTIDES AND PROTEINS**

lectures 2 hours	Small group work 1 hour
Peptides and proteins	Peptides and proteins

UNIT 14 (FIFTH WEEK):

**CARBOHYDRATES**

lectures 2 hours	Small group work 1 hour
Carbohydrates Mono-, di- and polysaccharides	Carbohydrates Mono-, di- and polysaccharides

UNIT 15 (FIFTH WEEK):

**LIPIDS**

lectures 2 hours	Small group work 1 hour
Lipids. Fatty acids. Phospholipids	Lipids. Fatty acids. Phospholipids

## WEEKLY COURSE SCHEDULE

COURSE	WEDNESDAY	THURSDAY	FRIDAY
<b>MEDICAL CHEMISTRY</b> from 01.11. to 01.12.	<b>LECTURES</b> <b>09:40 - 11:55</b> <b>14:10 - 16:25</b> (H44)  <b>PRACTICE</b> <b>16:30 - 19:30</b> (H44)	<b>PRACTICE</b> <b>08:00 - 11:00</b> (H44)	<b>PRACTICE</b> <b>15:30 - 18:30</b> (R18)

## LESSON SCHEDULE FOR THE SUBJECT MEDICAL CHEMISTRY

module	week	type	the name of the lesson	наставник
1	1	L	The importance of chemistry as a natural science. Basic chemical terms. Basic chemical laws.	Prof. Dr. Nedeljko Manojlović
			Ionic bond Covalent bond Intermolecular forces	Prof. Dr. Nedeljko Manojlović
			Solution Concentration Chemical reactions	Prof. Dr. Nedeljko Manojlović
1	1	SGW	Basic chemical terms	Prof. Dr. Nedeljko Manojlović Dr. Jovica Tomović
			Ionic bond Covalent bond Intermolecular forces	
			Preparation of the solution. Calculation of concentration.	
1	2	L	Acids, bases and salts. pH value. Buffers	Prof. Dr. Nedeljko Manojlović
			Periodic Table of Elements. Elements of the 1st, 2nd and 14th groups and their compounds.	Prof. Dr. Nedeljko Manojlović
			Elements of the 15th, 16th and 17th groups and their compounds	Prof. Dr. Nedeljko Manojlović
1	2	SGW	Acidity. Calculation of pH values. Buffers	Prof. Dr. Nedeljko Manojlović Dr. Jovica Tomović
			Periodic Table of Elements. Elements of the 1st, 2nd and 14th groups and their compounds.	
			Elements of the 15th, 16th and 17th groups and their compounds	

## LESSON SCHEDULE FOR THE SUBJECT MEDICAL CHEMISTRY

module	week	type	the name of the lesson	наставник
1	3	L	Halogen elements Organic chemistry. Functional group Alkanes, alkenes, alkynes and dienes Aromatic compounds	Prof. Dr. Nedeljko Manojlović
			Alkyl halides Alcohols, ethers, epoxies and phenols	Prof. Dr. Nedeljko Manojlović
			Aldehydes and ketones	Prof. Dr. Nedeljko Manojlović
1	3	SGW	Functional group. Alkanes, alkenes, alkynes and dienes Aromatic compounds	Prof. Dr. Nedeljko Manojlović Dr. Jovica Tomović
			Alkyl halides Alcohols, ethers, epoxies and phenols	
			Aldehydes and ketones Carboxylic acids and functional derivatives	
1	4	L	Carboxylic acids and functional derivatives Estri Organic sulfur compounds Organic nitrogen compounds	Prof. Dr. Nedeljko Manojlović
			Heterocyclic compounds. Amino acids.	Prof. Dr. Nedeljko Manojlović
			Secondary metabolites Alkaloids	Prof. Dr. Nedeljko Manojlović
1	4	SGW	Esters Organic sulfur compounds Organic nitrogen compounds	Prof. Dr. Nedeljko Manojlović Dr. Jovica Tomović

## LESSON SCHEDULE FOR THE SUBJECT MEDICAL CHEMISTRY

module	week	type	the name of the lesson	наставник
			Heterocyclic compounds Amino acids	
			Secondary metabolites Alkaloids	
1	5	L	Peptides and proteins	Prof. Dr. Nedeljko Manojlović
			Carbohydrates Mono-, di- and polysaccharides	Prof. Dr. Nedeljko Manojlović
			Lipids. Fatty acids. Phospholipids	Prof. Dr. Nedeljko Manojlović
1	5	SGW	Peptides and proteins	Prof. Dr. Nedeljko Manojlović Dr. Jovica Tomović
			Carbohydrates Mono-, di- and polysaccharides	
			Lipids. Fatty acids. Phospholipids	
		COL1	COLLOQUIUM 1	
		COL2	COLLOQUIUM 2	
		EX	EXAM	

Committee for taking the oral exam: Prof. Dr. Nedeljko Manojlović, chairman of the committee, Prof. Dr. Ratomir Jelić and Dr. Jovica Tomović