Faculty of Medicine in Rijeka

Curriculum
2023/2024

For course

Medical Chemistry And Biochemistry I

Study program:	**Medical Studies in English (R)** University integrated undergraduate and graduate study
Department:	**Department of Medical Chemistry, Biochemistry and Clinical Chemistry**
Course coordinator:	**prof. dr. sc. Čanadi Jurešić Gordana, dipl. ing.**
Year of study:	**1**
ECTS:	**8**
Incentive ECTS:	**0 (0.00%)**
Foreign language:	**Possibility of teaching in a foreign language**

Course information:

Course Objectives:
Acquire knowledge of chemical compounds, both inorganic and organic, that make up living cells or are used to synthesise them, chemical processes involved in their transformations, electrochemical processes, chemical kinetics, and thermochemistry. Acquire the ability to apply this knowledge to biological systems, which is important for understanding human metabolism under both physiological and pathological conditions.

Development of general and specific competencies (knowledge and skills):
Development of an awareness of the similarity and inseparability of chemical reactions in living and nonliving matter, the relationship between structure and reactivity, chemical and energetic transitions, the laws of thermodynamics. Development of the ability to use the acquired knowledge for the understanding of biochemical reactions in human organisms. Expanding knowledge of the relationships between the structure and physical/chemical properties of matter using simple molecules and their application to biomolecules. Solving numerical and logical problems in the field of Medical Chemistry and biochemistry. Development of skills necessary for experimental work, mastery of basic laboratory techniques and methods (chromatography, optical methods, pH measurement). Encouraging students to apply information technology and use the scientific literature. Building a sense of teamwork and developing the ability to think creatively and critically necessary to draw conclusions based on data obtained through analysis. Developing methods and skills necessary for presenting the results obtained.

Course correlativity and correspondence:
The content of the course Medical Chemistry and Biochemistry I correlates with and is complementary to the following courses: Medical Physics and Biophysics, Biochemistry II.

Approaches to teaching and learning:
Lectures, seminars, numerical and laboratory practicals.

List of assigned reading:

B. Blagović and M. Tota (Eds.): Handbook for Seminars and Laboratory Practicals in Medical Chemistry and Biochemistry I, Faculty of Medicine, University of Rijeka, Rijeka, 2019;

R.H. Petrucci, F.G. Herring, J.D. Madura, C. Bissonnette: General Chemistry - Principles and Modern Applications, 10th edition, Pearson Canada Inc., Toronto, Ontario, 2011; McMurry, J.: Fundamentals of Organic Chemistry, 8th Edition, Cengage Learning, 2017;

McMurry, J.: Fundamentals of Organic Chemistry, 8th Edition, Cengage Learning, 2017;

Murray R.K., Bender D.A., Botham K.M., Kennelly P.J., Rodwell V.W., and Weil P.A. (Eds): Harper's Illustrated Biochemistry, 30th Edition,The McGraw-Hill Companies, 2015

List of optional reading:

Reed, D.: Chemistry for Biologists, Pearson Education Ltd., Harlow, UK, 2013;

McMurry, J., Ballantine, D.S., Hoeger, C.A. and Peterson, V.E.: Fundamentals of General, Organic and Biological Chemistry, 7th Edition, Pearson Education Inc., USA, 2013.

Mahaffy, P., Tasker, R., Bucat, B., Kotz, J.C., Weaver, G.C. and Treichel, P.M.: Chemistry – Human activity, Chemical Reactivity, Nelson Education, USA, 2015.

Curriculum:

Lectures list (with titles and explanation):

L1 The Meaning of Chemistry and Biochemistry in the Study of Medicine. Matter

Explain the classification of matter

L2 Water and Water Solutions

Provide the basic facts about the quantity, distribution and the role of water in the body. Explain the structure and properties of water. Explain the dissolution of gasses and solid compounds in water.

L3 Solutions of Electrolytes

Distinguish electrolytes and nonelectrolytes. Explain the properties of solutions of acids, bases, ampholytes and salts

L4 Colligative Properties.

Define the principle of colligative properties. Explain vapour-pressure lowering, freezing point depression and boiling point elevation.

L5 Colligative Properties. Colloids.

Explain osmosis and dialysis. Define osmotic pressure. Explain colloids. Name and describe the types and properties of colloids. Explain the difference between the sol and gel state of colloids. Explain the principle of Donnan equilibrium. Describe electrophoresis

L6 Complex Compounds. Complex Salts. Chelates. Biological Chelates. Application of Chelators in Medicine

Describe the role of chelation in biological systems. Explain the effect of chelators and their use in medicine. Explain the principles of the complexometric method. Relate the structure and properties of apatite minerals (hydroxyapatite, fluorapatite).

L7 Chemical Kinetics. Rate, Order and Molecularity of Reaction

Define the basic principles of chemical kinetics. Define the rate of reaction and reaction order

L8 Factors Affecting the Rate of Reaction. Catalysis

Explain how various factors affect the rate of reaction. Describe the mechanism of action of catalysts. Explain the difference between chemical and biochemical catalysts.

L9 Chemical Equilibrium

Describe the law of mass action and the equilibrium constant. Define Le Chatelier's principle. Explain the impact of external factors on equilibrium

L10 Chemical Equilibrium.

Define the equilibrium of homogeneous and heterogeneous systems and electrolyte solutions. Define Ostwald’s dilution law. Define the solubility product. Describe calcified tissues and the formation of concrements. Distinguish dynamic equilibrium and consistent flow and its importance in biological systems

L11 Equilibrium of Chemical Reactions. Hydrolysis. Buffers.

Write the equilibrium constant of the chemical reaction. Write and explain hydrolysis constant. Explain the mechanism of buffer action. Write and explain Henderson-Hasselbalch equation.

L12 Thermodynamics. The First Law of Thermodynamics. Thermodynamic Quantities, State Functions of Thermodynamic Systems. Extensive and Intensive Properties.

Define the basic concepts of thermodynamics and basic thermodynamic quantities. Apply the first law of thermodynamics to biochemical systems.

L13 The Second Law of Thermodynamics. Free (Gibbs) Energy and the Direction of Chemical Reactions. Heat Capacity and Temperature.

Explain the effect of ΔG, ΔH, ΔS values on the spontaneity of reaction. Relate Gibbs' energy with the equilibrium constant

L14 Electrochemical Reactions. Galvanic Cells. Standard Redox Potential.

Explain the structure of the galvanic cell. Explain the meaning of standard reduction potential

L15 Electromotive Force. The Nernst Equation. Biological Redox Systems.

Write down and explain the Nernst equation. Name biologically important oxidation-reduction systems. Define the standard redox potential of biological systems. Explain Gibbs' energy of redox-systems.

L16 Structure of Organic Compounds. Types of Reactions in Chemistry of Organic Compounds.

Classify organic compounds according to functional groups and explain their chemical properties. Define the types of reactions of organic compounds. Explain the concept of nucleophile and electrophile

L17 Structure of Organic Compounds. Hybridization

Explain hybridization

L18 Structure of Organic Compounds. Resonance, Inductive Effect

Explain resonance and inductive effect.

L19 Isomerism

Define isomerism. Explain the types of isomerism (structural, positional, stereoisomerism, geometrical isomerism and conformational isomerism)

L20 Stereoisomerism: Optical Isomerism.

Define the chiral molecules. Explain D,L-steric order and R,S-system

L21 Biologically Important Oxygen Compounds: Alcohols, Phenols and Ethers

Explain the chemical properties of these classes of compounds and their reactivity. Explain the reactions of oxygen compounds.

L22 Biologically Important Oxygen Compounds: Aldehydes and Ketones.

Explain the significance of this group of compounds, their chemical properties and their reactivity.

L23: Biologically Important Oxygen Compounds: Aldehydes and Ketones.

Define tautomerism. Explain aldol condensation

L24 Carbohydrates

Explain their structure and chemical properties.

L25 Carbohydrates

Name and explain the structure of biologically most important monosaccharides, disaccharides and polysaccharides.

L26 Carboxylic Acids and their Derivatives

Explain the chemical properties of this class of compounds and their reactivity. Thioesters and acetyl-CoA.Name biologically important mono- and polycarboxylic acids

L27 Substituted Carboxylic Acids.

Name the biologically significant representatives. • Explain the structure and preparation of organic derivatives of carbonic acid.

L28 Lipids: Properties and Classification. Structure and Function of Important Lipid Classes.

Define lipids and explain their classification. Explain the structure and function of simple lipids.

L29 Structure and Function of Complex Lipids.

Explain the structure and function of phospholipids and sphingolipids.

L30 Structure and Function of Glycolipids. Isoprenoid Compounds.

Define and explain the classification and structure of glycolipids. Explain the structure and function of steroids and carotenoids.

L31 Role and Structure of Proteins. Relation Between Protein Structure and Function. Primary Structure

Describe the structural levels in the architecture of proteins. Define the primary structure

L32 Conformation of Peptide Chain and Secondary Structure of Proteins. Tertiary Structure. Myoglobin.

Define the secondary and tertiary structure of proteins. Explain the structure of myoglobin

L33 Quaternary Protein Structure. Haemoglobin. Mechanism of Oxygen Binding. Allosteric Effect.

Define the quaternary protein structure. Explain the allosteric properties of haemoglobin.

L 34 Cooperative Binding. The Bohr Effect.

Explain cooperativity. Explain Bohr effect.

L35 Heterocyclic Nitrogen, Oxygen and Sulphur Compounds.

Define heterocyclic compounds. Name biologically significant representatives

Practicals list (with titles and explanation):

LP1 General Laboratory Safety Procedures and Rules. Introduction to Qualitative Analysis –Identification of Cations and Anions. Qualitative Inorganic Analysis: Testing Salt Solutions for Anions and Cations

Basic chemistry lab equipment and techniques.
Detection and identification of different cations and anions in a solution.
Detection and identification of cations and anions in salt solutions

LP2 : Quantitative Chemical Analysis.

Name the main types of quantitative chemical analysis.
Describe and exemplify the volumetric methods. Volumetric analysis.
Employ the alkalimetric, manganometric and complexometric methods.

NP1,2: Solution stoichiometry

Solve numerical exercises

NP 3,4 : Chemical Kinetics

Describe the influence of temperature, concentration, pH and catalyst on the rate of oxidation of oxalic acid with potassium permanganate.
Solve numerical exercises.

LP3: Buffer Solutions

Prepare the phosphate buffer solutin and measure the pH as well as buffer capacity.

NP 5,6 : pH and Buffer Solutions.

Describe the mechanism of buffer action in body fluids.

Calculate the pH value of buffer solutions.

NP 7,8,9: Redox Reactions

Define the oxidant and reductant in redox reactions. Balance the redox reactions.

LP4 : Chemical Kinetics.

Investigate experimentally the influence of temperature, concentration, pH and catalyst on rate of reaction.

NP 10 :Aromatic compounds

Describe the bonding in benzene .Name simple aromatic compound from its structure, or write the structure, given the name. Draw their line-angle structural formulas. .Explain Electrophilic Aromatic Substitution Reactions

LP5 : Qualitative Organic Analysis

Detect and identify functional groups. Detect and identify amides and purines in solution

LP6 : Optical Methods. Spectrophotometry.

Determine the wavelength of maximum absorbance. Determine the influence of a concentration on absorbance. Determine the concentration of $CuSO_4$ in a solution using a spectrophotometer. Polarimetry. Determine the specific rotation angle of sugar. Make a calibration graph using sugar solutions with different concentrations. Determine the mass concentration of sugar in a sample by measuring the angle of rotation.

LP7 : Qualitative Analysis of Proteins and Amino Acids. Detection and Identification of Different Amino Acids in Various Sample Solutions. Quantitative Determination of Serum Proteins. Isoelectric Point. Thin Layer Chromatography (TLC) of Amino Acids

Determine the isoelectric point of a given protein solution. Perform a TLC for a given amino acids mixture. Quantitatively determine the concentration of serum proteins using the Biuret method.

Seminars list (with titles and explanation):

S1,2 Elements and Compounds.

Explain the structure of atoms, the periodic system and properties of elements that change periodically. List the biogenic elements and define their biological role. Explain the structure and define the properties of compounds.

S3 Chemical Bonds

Explain and identify chemical bonds

S 4 Intermolecular forces

Explain and identify intermolecular forces

S5,6 Acids and Bases. Salts.

Define acids and bases according to Arrhenius, Brønsted and Lewis.

Define salts.

Using charge balance, write the correct formula for an ionic compound.

S7,8 Salts. Hydrolysis.

Write equation of neutralisation. Balancing a chemical equation. Explain the hydrolysis of salts.

S9,10 Buffers. Mole. Solutions.

Define buffers and explain the mechanism of buffer action. Define the concept of mole and the concentration of solutions (fractions, molar and mass concentration, molality). Define intensive and extensive properties.

Solution concentrations and reactions.

S11,12 Solution Concentration.

Define saline solution (physiological solution). Dilution of solutions. Solve the exercises with concentrations.

S13,14 Colligative Properties (Lowering of Vapour Pressure, Elevation of Boiling Point, Depression of Freezing Point and Osmotic Pressure)

Define colligative properties. Solve exercises relating colligative properties.

S15,16 Equilibrium in the Solutions of Weak Electrolytes. Dissociation Constants of Acids and Bases. The Ionic Product of Water. pH

Define and write down the dissociation constants of acids and bases. Explain the ionisation of water and define the ionic product of water. Define pH. Define the pH of body fluids.

S17,18 Equilibrium in the Solutions of Weak Electrolytes. Numeric Exercises

Solve exercises using pH, the ionic product of water and dissociation constants.

S19,20 Reactions of Organic Compounds

Describe the characteristic reactions of organic compounds.

S21,22 Hydrocarbons

Classify and name hydrocarbons. Write down the characteristic reactions of hydrocarbons and aromatic compounds

S23,24 Alcohols, Ethers, Phenols and Thiols

Explain the chemical properties and reactivity of these groups of compounds. List biologically important representatives

S25 Amines

Explain the chemical properties and reactivity of this group of compounds. List biologically important representatives.

S 26,27,28 Aldehydes and Ketones

Explain the chemical properties and reactivity of these groups of compounds.

S29,30 Monosaccharides and Disaccharides

List biologically important representatives. Explain the formation of cyclic form. Explain the reactivity of monosaccharides and specify their stereoisomers

S31,32 Carboxylic Acids and their Derivatives

Explain the chemical properties and reactivity of these compounds.

S33,34 Substituted Carboxylic Acids

Name and define substituted carboxylic acids (halogen-, oxo-, hydroxy-, amino acids). Explain their chemical properties.

S35,36 Lipids. Fatty Acids.

Explain the physical properties of lipids. Define fatty acids and name important biological representatives. Explain the chemical properties of fatty acids

S37,38 Proteinogenic Amino Acids: Structure, Properties and Reactions.

Define chemical properties and general reactions. Classify amino acids. Distinguish essential and nonessential amino acids and glucogenic and ketogenic amino acids. Define and calculate the isoelectric point of amino acids

S39,40 Peptides. Myoglobin. Haemoglobin.

Explain the principles of synthesis and determination of sequence. Name the most important natural peptides and explain their role. Recognize levels of proteins. Explain the function of myoglobin and haemoglobin.

Student obligations:

All course announcements and class materials will be made available through the Merlin e-learning system. Classes are organized according to the schedule published in the Merlin e-learning system. Attendance at lectures, seminars, numerical and laboratory practicals and midterm exams is mandatory and is recorded separately for each of these forms and for each student. Classes will begin on time according to the established schedule, and tardiness will be counted as an absence. Entering and leaving the class during the lesson will not be allowed.
A student may be excused for up to 30% of the hours scheduled separately for practicals, seminars, and lectures solely for health reasons that must be excused by a doctor's note (including absences for midterm exams). In case of unexcused absence of more than 30 % of the hours of a specific form of instruction (11 hours of lecture, 13 hours of seminar, 10 hours of practicals), the student cannot continue the course and loses the possibility to take the final examination (0 ECTS points, grade F).

It is mandatory that absences from laboratory practicals be compensated by an oral colloquium.

Exam (exam taking, description of the written/oral/practical part of the exam, point distribution, grading criteria):

Students may earn a total of 100 credits: a maximum of 70 credits during the semester (three midterm written exams and laboratory practicals) and a maximum of 30 credits on the final exam. Students who have earned at least 35 credits during the semester will be admitted to the final exam. On all written and oral exams, the student must answer at least 50% of the answers correctly. Students who do not score at least 50% on the midterm exams may retake the midterm exams once, during the time of the final exam. Students who are not satisfied with the credits earned may also retake their midterm exams, but only the credits from the repeated midterm exams will be considered.
SPECIFIC PROVISIONS FOR ONLINE TEACHING: In accordance with the University of Rijeka's current "Recommendations for Appropriate Conduct in Virtual Systems for the Delivery of Online Instruction and Other Forms of Work in a Virtual Environment" (3.3.2021), certain forms of instruction will be delivered in an online environment in real time according to the published schedule. Lectures, seminars, and practicals will be held on MS Teams, and students should have their camera on for the entire duration of class and a microphone available when interacting. Repeated inability to turn on the camera and/or microphone will be counted as an absence.

The evaluation of students is carried out in accordance with the valid study regulations of the University of Rijeka and the Regulation on the Evaluation of Students at the Faculty of Medicine in Rijeka (adopted by the Faculty Council of the Faculty of Medicine in Rijeka). Evaluation of students' progress during classes, midterms and the final exam is shown in the table:

		CREDITS
Midterm exams	I General and inorganic chemistry	16 (x score)
	II Stoichiometry	10 (x score)
	III Organic chemistry and biochemistry I	26 (x score)
	Total	**52**
Class activity	**Total**	**4**
Laboratory practicals	Practicals and reports	**14**
TOTAL		**70**
Final exam	Written exam	15 (x score)
	Oral exam	15
	Total	**30**
TOTAL		**100**

Midterm exams:
There are three midterm exams during the semester. The first covers the content of bioinorganic, general, and physical chemistry, the second covers stoichiometry, and the third covers organic chemistry and biochemistry (theory, nomenclature, and structural formulas).

Class activity:

There are several ways to earn credits in this category, **(but only) during the semester.** There are several small tests that cover a specific part of the materia. In consultation with the course coordinator, students may also complete a small research paper on a specific topic. Activity and engagement in class as well as special preparation for class are also be rewarded. Students may receive 0.5-1 credit per activity.

Laboratory practicals:

Students may earn a maximum of 14 credits through 7 laboratory practicals. Each completed lab earns **2 credits: 1 for lab work successfully completed and 1 for a completed written report after each practical.** Grades for lab work will be based on the written entrance test (5 short questions; students with 2 or fewer correct answers will not be allowed to attend the practical), activity during the work, and laboratory skills. **A report must be written for each exercise and submitted by the due date**. Any errors must be corrected on resubmission, which will be done with a subsequent report. Only one correction is allowed, and the report is graded thereafter. Grading is based primarily on the quality of the original report (accuracy and neatness), but if corrections are not made appropriately or within a specified time, the report will be graded 0. If more than 30% of the lab work or 30% of the reports are graded 0, or if the total sum of all lab grades is less than 7 (i.e. 50% of the total lab grades), the student will not be allowed to take the final exam. Absence (for any reason) from a laboratory practical must be compensated **by an oral colloquium** within one week of the practical; a successful colloquium earns a total of 0.5 credits. Repetition of the colloquium is not permitted.

Final exam: The final examination consists of a written exam (15 credits) and an oral exam (15 credits). Students must pass both parts of the final exam. If students pass the written part of the final exam but not the oral part, they must repeat the written part in the next term of the final exam. There is therefore no transfer of points from the written part to the next exam.

Assessment of the oral part of the final exam:
7.5 – 8 credits: minimum criteria satisfied
9 – 11 credits: average criteria satisfied with noticeable errors
12 – 13 credits: answer with a few errors
14 – 15 credits: outstanding answer.

The ECTS grading system is defined by the following criteria:
A (5, excellent) 90-100 credits
B (4, very good) 75-89.99 credits
C (3, good) 60-74.99 credits
D (2, sufficient) 50-59.99 credits
F (1, insufficient, fail) less than 50 credits

Other notes (related to the course) important for students:

A student who gains less than 35 credits during the pre-exam period, has failed the course.

Communication with professors and assistants: Contact with professors and assistants can be made directly during/after classes, through consultations, by e-mail or via the Merlin platform (Forum or Chat).
Consultations are held in agreement with professors and assistants at the scheduled time. e-mails:
Course coordinator: Assoc. Prof. Gordana Čanadi Jurešić, gordanacj@medri.uniri.hr
Collaborators:
Prof. Srećko Valić, svalic@medri.uniri.hr
Assoc. prof. Marin Tota, marin.tota@medri.uniri.hr
Assoc. prof. Lara Batičić, lara.baticic@medri.uniri.hr
Assoc. prof. Mirna Petković Didović, mirnapd@medri.uniri.hr
Assist. prof. Jelena Marinić, Jelena.marinic@medri.uniri.hr
Assoc. prof. Damir Klepac, damir.klepac@medri.uniri.hr
Iva Vukelić, PhD, iva.vukelic@medri.uniri.hr

Midterm and final exam results, notifications, and all other course information will be posted regularly on the Merlin platform.

COURSE HOURS 2023/2024

Medical Chemistry And Biochemistry I

Lectures (Place and time or group)	**Practicals** (Place and time or group)	**Seminars** (Place and time or group)
04.10.2023		
L1 The Meaning of Chemistry and Biochemistry in the Study of Medicine. Matter: • P08 (10:15 - 13:00) [346] ○ MCAB L2 Water and Water Solutions: • P08 (10:15 - 13:00) [346] ○ MCAB L3 Solutions of Electrolytes: • P08 (10:15 - 13:00) [346] ○ MCAB		S1,2 Elements and Compounds.: • P09 - TEACHING IN ENGLISH (13:15 - 16:00) [349] ○ MCAB-S2 S3 Chemical Bonds: • P09 - TEACHING IN ENGLISH (13:15 - 16:00) [349] ○ MCAB-S2
izv. prof. dr. sc. Petković Didović Mirna, dipl. ing. kemije [349] · prof. dr. sc. Čanadi Jurešić Gordana, dipl. ing. [346]		
05.10.2023		
		S 4 Intermolecular forces: • P09 - TEACHING IN ENGLISH (08:00 - 10:30) [349] ○ MCAB-S2 S5,6 Acids and Bases. Salts.: • P09 - TEACHING IN ENGLISH (08:00 - 10:30) [349] ○ MCAB-S2 S1,2 Elements and Compounds.: • P09 - TEACHING IN ENGLISH (11:00 - 14:00) [349] ○ MCAB-S1 S3 Chemical Bonds: • P09 - TEACHING IN ENGLISH (11:00 - 14:00) [349] ○ MCAB-S1
izv. prof. dr. sc. Petković Didović Mirna, dipl. ing. kemije [349]		
06.10.2023		
		S 4 Intermolecular forces: • P09 - TEACHING IN ENGLISH (08:15 - 11:00) [349] ○ MCAB-S1 S5,6 Acids and Bases. Salts.: • P09 - TEACHING IN ENGLISH (08:15 - 11:00) [349] ○ MCAB-S1
izv. prof. dr. sc. Petković Didović Mirna, dipl. ing. kemije [349]		
10.10.2023		

		S7,8 Salts. Hydrolysis.:
		• P04 (08:15 - 10:00) [348]
		  ○ MCAB-S2
		• P04 (10:15 - 12:00) [349]
		  ○ MCAB-S1

prof. dr. sc. Batičić Lara, dipl. sanit. ing. [348] · izv. prof. dr. sc. Petković Didović Mirna, dipl. ing. kemije [349]		
11.10.2023		

L4 Colligative Properties.:
• P08 (10:15 - 12:00) [348]
  ○ MCAB
 	
L5 Colligative Properties. Colloids.:
• P08 (10:15 - 12:00) [348]
  ○ MCAB
		S9,10 Buffers. Mole. Solutions.:
		• P07 (12:15 - 14:00) [348]
		  ○ MCAB-S1

prof. dr. sc. Batičić Lara, dipl. sanit. ing. [348]		
12.10.2023		

	LP1 General Laboratory Safety Procedures and Rules. Introduction to Qualitative Analysis –Identification of Cations and Anions. Qualitative Inorganic Analysis: Testing Salt Solutions for Anions and Cations:
	• Department of Med. chemistry, biochemistry and clin. chemistry (12:15 - 15:00) [351]
	  ○ MCAB-P1
	• Department of Med. chemistry, biochemistry and clin. chemistry (13:15 - 16:00) [348]
	  ○ MCAB-P2
		S9,10 Buffers. Mole. Solutions.:
		• P07 (08:15 - 10:00) [348]
		  ○ MCAB-S2

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13.10.2023		
	LP1 General Laboratory Safety Procedures and Rules. Introduction to Qualitative Analysis –Identification of Cations and Anions. Qualitative Inorganic Analysis: Testing Salt Solutions for Anions and Cations: • Department of Med. chemistry, biochemistry and clin. chemistry (08:15 - 11:00) [351] ○ MCAB-P3	
doc. dr. sc. Vukelić Iva, dipl. sanit. ing. [351]		
16.10.2023		
L6 Complex Compounds. Complex Salts. Chelates. Biological Chelates. Application of Chelators in Medicine: • P08 (11:15 - 12:00) [344] ○ MCAB		
prof. dr. sc. Tota Marin, mr. pharm. [344]		
19.10.2023		

		S11,12 Solution Concentration.:
		• P15 - TOWN HALL (08:15 - 10:00) [349]
		  ◦ MCAB-S2
		• P09 - TEACHING IN ENGLISH (11:15 - 13:00) [348]
		  ◦ MCAB-S1

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20.10.2023		

		S13,14 Colligative Properties (Lowering of Vapour Pressure, Elevation of Boiling Point, Depression of Freezing Point and Osmotic Pressure):
		• P09 - TEACHING IN ENGLISH (08:15 - 10:00) [349]
		  ◦ MCAB-S2
		• P04 (08:15 - 10:00) [350]
		  ◦ MCAB-S1

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24.10.2023		

	NP1,2: Solution stoichiometry:
	• P04 (08:15 - 10:00) [348]
	  ◦ MCAB-S2
	• P04 (10:15 - 12:00) [349]
	  ◦ MCAB-S1	

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25.10.2023		

L7 Chemical Kinetics. Rate, Order and Molecularity of Reaction:
• P08 (10:15 - 12:00) [350]
  ◦ MCAB
 	
L8 Factors Affecting the Rate of Reaction. Catalysis:
• P08 (10:15 - 12:00) [350]
  ◦ MCAB
	NP 3,4 : Chemical Kinetics:
	• P07 (12:15 - 14:00) [350]
	  ◦ MCAB-S1	

izv. prof. dr. sc. Klepac Damir, dipl. ing. [350]		
26.10.2023		

	NP 3,4 : Chemical Kinetics:
	• P09 - TEACHING IN ENGLISH (08:15 - 10:00) [350]
	  ◦ MCAB-S2
	
	LP2 : Quantitative Chemical Analysis.:
	• Department of Med. chemistry, biochemistry and clin. chemistry (12:15 - 15:00) [351]
	  ◦ MCAB-P1
	• Department of Med. chemistry, biochemistry and clin. chemistry (13:15 - 16:00) [349]
	  ◦ MCAB-P2	

izv. prof. dr. sc. Klepac Damir, dipl. ing. [350] · izv. prof. dr. sc. Petković Didović Mirna, dipl. ing. kemije [349] · doc. dr. sc. Vukelić Iva, dipl. sanit. ing. [351]		

27.10.2023		
	LP2 : Quantitative Chemical Analysis.: • Department of Med. chemistry, biochemistry and clin. chemistry (08:15 - 11:00) [351] ◦ MCAB-P3	
doc. dr. sc. Vukelić Iva, dipl. sanit. ing. [351]		
30.10.2023		
L9 Chemical Equilibrium: • P08 (10:15 - 13:00) [345] ◦ MCAB L10 Chemical Equilibrium.: • P08 (10:15 - 13:00) [345] ◦ MCAB L11 Equilibrium of Chemical Reactions. Hydrolysis. Buffers.: • P08 (10:15 - 13:00) [345] ◦ MCAB		
prof. dr. sc. Valić Srećko, prof. [345]		
02.11.2023		
		S15,16 Equilibrium in the Solutions of Weak Electrolytes. Dissociation Constants of Acids and Bases. The Ionic Product of Water. pH: • v (08:15 - 10:00) [350] ◦ MCAB-S2 • v (11:15 - 13:00) [350] ◦ MCAB-S1
izv. prof. dr. sc. Klepac Damir, dipl. ing. [350]		
07.11.2023		
	NP 5,6 : pH and Buffer Solutions.: • P04 (08:15 - 10:00) [348] ◦ MCAB-S2	
prof. dr. sc. Batičić Lara, dipl. sanit. ing. [348]		
08.11.2023		
L12 Thermodynamics. The First Law of Thermodynamics. Thermodynamic Quantities, State Functions of Thermodynamic Systems. Extensive and Intensive Properties.: • P08 (10:15 - 12:00) [349] ◦ MCAB L13 The Second Law of Thermodynamics. Free (Gibbs) Energy and the Direction of Chemical Reactions. Heat Capacity and Temperature.: • P08 (10:15 - 12:00) [349] ◦ MCAB	NP 5,6 : pH and Buffer Solutions.: • P07 (12:15 - 14:00) [348] ◦ MCAB-S1	

prof. dr. sc. Batičić Lara, dipl. sanit. ing. [348] · izv. prof. dr. sc. Petković Didović Mirna, dipl. ing. kemije [349]		
09.11.2023		
	LP3: Buffer Solutions: • Department of Med. chemistry, biochemistry and clin. chemistry (13:00 - 15:00) [351] ◦ MCAB-P3	S17,18 Equilibrium in the Solutions of Weak Electrolytes. Numeric Exercises: • Department of Anatomy - Seminarska (08:15 - 10:00) [350] ◦ MCAB-S2 • v (11:15 - 13:00) [350] ◦ MCAB-S1
izv. prof. dr. sc. Klepac Damir, dipl. ing. [350] · doc. dr. sc. Vukelić Iva, dipl. sanit. ing. [351]		
10.11.2023		
	LP3: Buffer Solutions: • Department of Med. chemistry, biochemistry and clin. chemistry (08:00 - 10:00) [348] ◦ MCAB-P1 • Department of Med. chemistry, biochemistry and clin. chemistry (10:00 - 12:00) [349] ◦ MCAB-P2	
prof. dr. sc. Batičić Lara, dipl. sanit. ing. [348] · izv. prof. dr. sc. Petković Didović Mirna, dipl. ing. kemije [349]		
15.11.2023		
L14 Electrochemical Reactions. Galvanic Cells. Standard Redox Potential.: • P08 (10:15 - 12:00) [344] ◦ MCAB L15 Electromotive Force. The Nernst Equation. Biological Redox Systems.: • P08 (10:15 - 12:00) [344] ◦ MCAB	NP 7,8,9: Redox Reactions: • P07 (12:15 - 15:00) [349] ◦ MCAB-S1	
izv. prof. dr. sc. Petković Didović Mirna, dipl. ing. kemije [349] · prof. dr. sc. Tota Marin, mr. pharm. [344]		
16.11.2023		
	NP 7,8,9: Redox Reactions: • P07 (08:00 - 10:30) [350] ◦ MCAB-S2	
izv. prof. dr. sc. Klepac Damir, dipl. ing. [350]		
17.11.2023		
	LP4 : Chemical Kinetics.: • Department of Med. chemistry, biochemistry and clin. chemistry (08:00 - 10:00) [348] ◦ MCAB-P3 • Department of Med. chemistry, biochemistry and clin. chemistry (10:00 - 12:00) [351] ◦ MCAB-P2 • Department of Med. chemistry, biochemistry and clin. chemistry (12:00 - 14:00) [351] ◦ MCAB-P1	
prof. dr. sc. Batičić Lara, dipl. sanit. ing. [348] · doc. dr. sc. Vukelić Iva, dipl. sanit. ing. [351]		

22.11.2023		

L16 Structure of Organic Compounds. Types of Reactions in Chemistry of Organic Compounds.:
• P08 (10:15 - 13:00) [348]
  ◦ MCAB
 	
L17 Structure of Organic Compounds. Hybridization:
• P08 (10:15 - 13:00) [348]
  ◦ MCAB
 	
L18 Structure of Organic Compounds. Resonance, Inductive Effect:
• P08 (10:15 - 13:00) [348]
  ◦ MCAB		

prof. dr. sc. Batičić Lara, dipl. sanit. ing. [348]		
29.11.2023		

L19 Isomerism:
• P08 (10:15 - 12:00) [346]
  ◦ MCAB
 	
L20 Stereoisomerism: Optical Isomerism.:
• P08 (10:15 - 12:00) [346]
  ◦ MCAB
		S19,20 Reactions of Organic Compounds:
		• P09 - TEACHING IN ENGLISH (12:15 - 14:00) [348]
		  ◦ MCAB-S2
		  ◦ MCAB

prof. dr. sc. Batičić Lara, dipl. sanit. ing. [348] · prof. dr. sc. Čanadi Jurešić Gordana, dipl. ing. [346]		
30.11.2023		

		S21,22 Hydrocarbons:
		• P09 - TEACHING IN ENGLISH (08:15 - 10:00) [348]
		  ◦ MCAB-S2
		• P01 (15:15 - 17:00) [348]
		  ◦ MCAB-S1
		  ◦ MCAB
		
		S19,20 Reactions of Organic Compounds:
		• P09 - TEACHING IN ENGLISH (11:15 - 13:00) [348]
		  ◦ MCAB-S1

prof. dr. sc. Batičić Lara, dipl. sanit. ing. [348]		
06.12.2023		

L21 Biologically Important Oxygen Compounds: Alcohols, Phenols and Ethers:
• P08 (10:15 - 13:00) [346]
  ◦ MCAB
 	
L22 Biologically Important Oxygen Compounds: Aldehydes and Ketones.:
• P08 (10:15 - 13:00) [346]
  ◦ MCAB
 	
L23: Biologically Important Oxygen Compounds: Aldehydes and Ketones.:
• P08 (10:15 - 13:00) [346]
  ◦ MCAB		

prof. dr. sc. Čanadi Jurešić Gordana, dipl. ing. [346]		
07.12.2023		

	LP5 : Qualitative Organic Analysis:
	• Department of Med. chemistry, biochemistry and clin. chemistry (13:00 - 16:00) [351] [349]
	  ◦ MCAB-P2
	  ◦ MCAB-P1
		S23,24 Alcohols, Ethers, Phenols and Thiols:
		• P06 (08:15 - 10:00) [350]
		  ◦ MCAB-S2
		• P06 (10:45 - 12:30) [350]
		  ◦ MCAB-S1

izv. prof. dr. sc. Klepac Damir, dipl. ing. [350] · izv. prof. dr. sc. Petković Didović Mirna, dipl. ing. kemije [349] · doc. dr. sc. Vukelić Iva, dipl. sanit. ing. [351]		
08.12.2023		

	LP5 : Qualitative Organic Analysis:
	• Department of Med. chemistry, biochemistry and clin. chemistry (08:00 - 11:00) [351]
	  ◦ MCAB-P3
	
	NP 10 :Aromatic compounds:
	• P06 (09:00 - 10:00) [346]
	  ◦ MCAB-S1
	• P06 (12:00 - 13:00) [346]
	  ◦ MCAB-S2
		S25 Amines:
		• P06 (08:15 - 09:00) [346]
		  ◦ MCAB-S1
		• P06 (10:15 - 11:00) [346]
		  ◦ MCAB-S2

doc. dr. sc. Vukelić Iva, dipl. sanit. ing. [351] · prof. dr. sc. Čanadi Jurešić Gordana, dipl. ing. [346]		
13.12.2023		

L24 Carbohydrates:
• P08 (10:15 - 13:00) [346]
  ◦ MCAB
 	
L25 Carbohydrates:
• P08 (10:15 - 13:00) [346]
  ◦ MCAB		

prof. dr. sc. Čanadi Jurešić Gordana, dipl. ing. [346]		
14.12.2023		
		S 26,27,28 Aldehydes and Ketones: • P04 (13:15 - 16:00) [346] ◦ MCAB-S2

prof. dr. sc. Čanadi Jurešić Gordana, dipl. ing. [346]		
15.12.2023		
		S 26,27,28 Aldehydes and Ketones: • P04 (08:15 - 11:00) [346] ◦ MCAB ◦ MCAB-S1
prof. dr. sc. Čanadi Jurešić Gordana, dipl. ing. [346]		
18.12.2023		
		S29,30 Monosaccharides and Disaccharides: • P09 - TEACHING IN ENGLISH (14:15 - 16:00) [346] ◦ MCAB-S1
prof. dr. sc. Čanadi Jurešić Gordana, dipl. ing. [346]		
19.12.2023		
		S29,30 Monosaccharides and Disaccharides: • P04 (14:15 - 16:00) [346] ◦ MCAB-S2
prof. dr. sc. Čanadi Jurešić Gordana, dipl. ing. [346]		
20.12.2023		
L26 Carboxylic Acids and their Derivatives: • P08 (10:15 - 12:00) [348] ◦ MCAB L27 Substituted Carboxylic Acids.: • P08 (10:15 - 12:00) [348] ◦ MCAB		
prof. dr. sc. Batičić Lara, dipl. sanit. ing. [348]		
21.12.2023		
		S31,32 Carboxylic Acids and their Derivatives: • P06 (08:15 - 10:00) [348] ◦ MCAB-S2 • P06 (11:15 - 13:00) [348] ◦ MCAB-S1
prof. dr. sc. Batičić Lara, dipl. sanit. ing. [348]		
09.01.2024		
		S33,34 Substituted Carboxylic Acids: • v (14:15 - 16:00) [348] ◦ MCAB-S1
prof. dr. sc. Batičić Lara, dipl. sanit. ing. [348]		
10.01.2024		

L28 Lipids: Properties and Classification. Structure and Function of Important Lipid Classes.:
• P08 (08:15 - 11:00) [346]
  ○ MCAB
 	
L29 Structure and Function of Complex Lipids.:
• P08 (08:15 - 11:00) [346]
  ○ MCAB
 	
L30 Structure and Function of Glycolipids. Isoprenoid Compounds.:
• P08 (08:15 - 11:00) [346]
  ○ MCAB
		S35,36 Lipids. Fatty Acids.:
		• P07 (12:15 - 14:00) [346]
		  ○ MCAB-S2

prof. dr. sc. Čanadi Jurešić Gordana, dipl. ing. [346]		
11.01.2024		

	LP6 : Optical Methods. Spectrophotometry.:
	• Department of Med. chemistry, biochemistry and clin. chemistry (12:00 - 16:00) [351]
	  ○ MCAB-P1
	• Department of Med. chemistry, biochemistry and clin. chemistry (13:00 - 17:00) [349]
	  ○ MCAB-P2
		S33,34 Substituted Carboxylic Acids:
		• P03 - IT CLASSROOM (08:00 - 10:00) [348]
		  ○ MCAB-S2

prof. dr. sc. Batičić Lara, dipl. sanit. ing. [348] · izv. prof. dr. sc. Petković Didović Mirna, dipl. ing. kemije [349] · doc. dr. sc. Vukelić Iva, dipl. sanit. ing. [351]		
12.01.2024		

	LP6 : Optical Methods. Spectrophotometry.:
	• Department of Med. chemistry, biochemistry and clin. chemistry (08:00 - 12:00) [349]
	  ○ MCAB-P3
		S35,36 Lipids. Fatty Acids.:
		• P07 (08:15 - 10:00) [346]
		  ○ MCAB-S1

izv. prof. dr. sc. Petković Didović Mirna, dipl. ing. kemije [349] · prof. dr. sc. Čanadi Jurešić Gordana, dipl. ing. [346]		
15.01.2024		
		S37,38 Proteinogenic Amino Acids: Structure, Properties and Reactions.: • P07 (12:15 - 14:00) [346] ○ MCAB-S1
prof. dr. sc. Čanadi Jurešić Gordana, dipl. ing. [346]		
17.01.2024		

L31 Role and Structure of Proteins. Relation Between Protein Structure and Function. Primary Structure:
• P08 (10:15 - 12:00) [518]
  ○ MCAB
 	
L32 Conformation of Peptide Chain and Secondary Structure of Proteins. Tertiary Structure. Myoglobin.:
• P08 (10:15 - 12:00) [518]
  ○ MCAB
		S37,38 Proteinogenic Amino Acids: Structure, Properties and Reactions.:
		• P09 - TEACHING IN ENGLISH (08:15 - 10:00) [346]
		  ○ MCAB-S2

doc. dr. sc. Marinić Jelena, dipl. ing. [518] · prof. dr. sc. Čanadi Jurešić Gordana, dipl. ing. [346]		

18.01.2024		
	LP7 : Qualitative Analysis of Proteins and Amino Acids. Detection and Identification of Different Amino Acids in Various Sample Solutions. Quantitative Determination of Serum Proteins. Isoelectric Point. Thin Layer Chromatography (TLC) of Amino Acids: • Department of Med. chemistry, biochemistry and clin. chemistry (12:00 - 15:00) [351] ◦ MCAB-P1 • Department of Med. chemistry, biochemistry and clin. chemistry (13:00 - 16:00) [348] ◦ MCAB-P2	
prof. dr. sc. Batičić Lara, dipl. sanit. ing. [348] · doc. dr. sc. Vukelić Iva, dipl. sanit. ing. [351]		
19.01.2024		
	LP7 : Qualitative Analysis of Proteins and Amino Acids. Detection and Identification of Different Amino Acids in Various Sample Solutions. Quantitative Determination of Serum Proteins. Isoelectric Point. Thin Layer Chromatography (TLC) of Amino Acids: • Department of Med. chemistry, biochemistry and clin. chemistry (08:00 - 11:00) [351] ◦ MCAB-P3	
doc. dr. sc. Vukelić Iva, dipl. sanit. ing. [351]		
22.01.2024		
		S39,40 Peptides. Myoglobin. Haemoglobin.: • P08 (12:15 - 14:00) [351] ◦ MCAB-S1
doc. dr. sc. Vukelić Iva, dipl. sanit. ing. [351]		
24.01.2024		
L33 Quaternary Protein Structure. Haemoglobin. Mechanism of Oxygen Binding. Allosteric Effect.: • P08 (10:15 - 13:00) [518] [349] ◦ MCAB L 34 Cooperative Binding. The Bohr Effect.: • P08 (10:15 - 13:00) [518] [349] ◦ MCAB L35 Heterocyclic Nitrogen, Oxygen and Sulphur Compounds.: • P08 (10:15 - 13:00) [518] [349] ◦ MCAB		S39,40 Peptides. Myoglobin. Haemoglobin.: • P09 - TEACHING IN ENGLISH (08:15 - 10:00) [351] ◦ MCAB-S2
doc. dr. sc. Marinić Jelena, dipl. ing. [518] · izv. prof. dr. sc. Petković Didović Mirna, dipl. ing. kemije [349] · doc. dr. sc. Vukelić Iva, dipl. sanit. ing. [351]		

List of lectures, seminars and practicals:

LECTURES (TOPIC)	Number of hours	Location

L1 The Meaning of Chemistry and Biochemistry in the Study of Medicine. Matter	1	P08
L2 Water and Water Solutions	1	P08
L3 Solutions of Electrolytes	1	P08
L4 Colligative Properties.	1	P08
L5 Colligative Properties. Colloids.	1	P08
L6 Complex Compounds. Complex Salts. Chelates. Biological Chelates. Application of Chelators in Medicine	1	P08
L7 Chemical Kinetics. Rate, Order and Molecularity of Reaction	1	P08
L8 Factors Affecting the Rate of Reaction. Catalysis	1	P08
L9 Chemical Equilibrium	1	P08
L10 Chemical Equilibrium.	1	P08
L11 Equilibrium of Chemical Reactions. Hydrolysis. Buffers.	1	P08
L12 Thermodynamics. The First Law of Thermodynamics. Thermodynamic Quantities, State Functions of Thermodynamic Systems. Extensive and Intensive Properties.	1	P08
L13 The Second Law of Thermodynamics. Free (Gibbs) Energy and the Direction of Chemical Reactions. Heat Capacity and Temperature.	1	P08
L14 Electrochemical Reactions. Galvanic Cells. Standard Redox Potential.	1	P08
L15 Electromotive Force. The Nernst Equation. Biological Redox Systems.	1	P08
L16 Structure of Organic Compounds. Types of Reactions in Chemistry of Organic Compounds.	1	P08
L17 Structure of Organic Compounds. Hybridization	1	P08
L18 Structure of Organic Compounds. Resonance, Inductive Effect	1	P08
L19 Isomerism	1	P08
L20 Stereoisomerism: Optical Isomerism.	1	P08
L21 Biologically Important Oxygen Compounds: Alcohols, Phenols and Ethers	1	P08
L22 Biologically Important Oxygen Compounds: Aldehydes and Ketones.	1	P08
L23: Biologically Important Oxygen Compounds: Aldehydes and Ketones.	1	P08
L24 Carbohydrates	1	P08
L25 Carbohydrates	1	P08
L26 Carboxylic Acids and their Derivatives	1	P08
L27 Substituted Carboxylic Acids.	1	P08
L28 Lipids: Properties and Classification. Structure and Function of Important Lipid Classes.	1	P08
L29 Structure and Function of Complex Lipids.	1	P08
L30 Structure and Function of Glycolipids. Isoprenoid Compounds.	1	P08
L31 Role and Structure of Proteins. Relation Between Protein Structure and Function. Primary Structure	1	P08
L32 Conformation of Peptide Chain and Secondary Structure of Proteins. Tertiary Structure. Myoglobin.	1	P08

L33 Quaternary Protein Structure. Haemoglobin. Mechanism of Oxygen Binding. Allosteric Effect.	1	P08
L 34 Cooperative Binding. The Bohr Effect.	1	P08
L35 Heterocyclic Nitrogen, Oxygen and Sulphur Compounds.	1	P08

PRACTICALS (TOPIC)	Number of hours	Location
LP1 General Laboratory Safety Procedures and Rules. Introduction to Qualitative Analysis –Identification of Cations and Anions. Qualitative Inorganic Analysis: Testing Salt Solutions for Anions and Cations	3	Department of Med. chemistry, biochemistry and clin. chemistry
LP2 : Quantitative Chemical Analysis.	3	Department of Med. chemistry, biochemistry and clin. chemistry
NP1,2: Solution stoichiometry	2	P04
NP 3,4 : Chemical Kinetics	2	P07 P09 - TEACHING IN ENGLISH
LP3: Buffer Solutions	2	Department of Med. chemistry, biochemistry and clin. chemistry
NP 5,6 : pH and Buffer Solutions.	2	P04 P07
NP 7,8,9: Redox Reactions	3	P07
LP4 : Chemical Kinetics.	2	Department of Med. chemistry, biochemistry and clin. chemistry
NP 10 :Aromatic compounds	1	P06
LP5 : Qualitative Organic Analysis	3	Department of Med. chemistry, biochemistry and clin. chemistry
LP6 : Optical Methods. Spectrophotometry.	4	Department of Med. chemistry, biochemistry and clin. chemistry
LP7 : Qualitative Analysis of Proteins and Amino Acids. Detection and Identification of Different Amino Acids in Various Sample Solutions. Quantitative Determination of Serum Proteins. Isoelectric Point. Thin Layer Chromatography (TLC) of Amino Acids	3	Department of Med. chemistry, biochemistry and clin. chemistry

SEMINARS (TOPIC)	Number of hours	Location
S1,2 Elements and Compounds.	2	P09 - TEACHING IN ENGLISH
S3 Chemical Bonds	1	P09 - TEACHING IN ENGLISH
S 4 Intermolecular forces	1	P09 - TEACHING IN ENGLISH
S5,6 Acids and Bases. Salts.	2	P09 - TEACHING IN ENGLISH
S7,8 Salts. Hydrolysis.	2	P04
S9,10 Buffers. Mole. Solutions.	2	P07
S11,12 Solution Concentration.	2	P09 - TEACHING IN ENGLISH P15 - TOWN HALL
S13,14 Colligative Properties (Lowering of Vapour Pressure, Elevation of Boiling Point, Depression of Freezing Point and Osmotic Pressure)	2	P04 P09 - TEACHING IN ENGLISH
S15,16 Equilibrium in the Solutions of Weak Electrolytes. Dissociation Constants of Acids and Bases. The Ionic Product of Water. pH	2	v

S17,18 Equilibrium in the Solutions of Weak Electrolytes. Numeric Exercises	2	Department of Anatomy - Seminarska v
S19,20 Reactions of Organic Compounds	2	P09 - TEACHING IN ENGLISH
S21,22 Hydrocarbons	2	P01 P09 - TEACHING IN ENGLISH
S23,24 Alcohols, Ethers, Phenols and Thiols	2	P06
S25 Amines	1	P06
S 26,27,28 Aldehydes and Ketones	3	P04
S29,30 Monosaccharides and Disaccharides	2	P04 P09 - TEACHING IN ENGLISH
S31,32 Carboxylic Acids and their Derivatives	2	P06
S33,34 Substituted Carboxylic Acids	2	P03 - IT CLASSROOM v
S35,36 Lipids. Fatty Acids.	2	P07
S37,38 Proteinogenic Amino Acids: Structure, Properties and Reactions.	2	P07 P09 - TEACHING IN ENGLISH
S39,40 Peptides. Myoglobin. Haemoglobin.	2	P08 P09 - TEACHING IN ENGLISH

EXAM DATES (final exam):

1.	07.02.2024.
2.	21.02.2024.
3.	08.07.2024.
4.	04.09.2024.
5.	18.09.2024.