

<i>Name of the course</i>	Medical Chemistry			Code	
<i>Type of study program Cycle</i>	Integrated university study, medicine			Year of study	I
<i>Credits (ECTS) :</i>	7,5	<i>Semester</i>	II	Number of hours per semester (1+e+s)	80 (24+26+30)
<i>Status of the course:</i>	Mandatory	<i>Preconditions:</i>		<i>Comparative conditions:</i>	
<i>Access to course:</i>	First year students			<i>Hours of instructions:</i>	According to schedule
<i>Course teacher:</i>	Assistant Professor Ivana Martinović, PhD				
<i>Consultations:</i>	As agreed				
<i>E-mail address and phone number:</i>	ivana.martinovic@fpmoz.sum.ba +387 (0)63 445 453				
<i>Associate teachers:</i>	Associate Professor Ilijana Odak, PhD Gloria Zlatic, mag. biol. et chem., assistant				
<i>Consultations:</i>	As agreed				
<i>E-mail address and phone number:</i>	ilijana.odak@fpmoz.sum.ba +387 (0)63 445 478 gloria.zlatic@fpmoz.sum.ba +387 (0)63 445 476				

<p><i>The aims of the course:</i></p>	<p>The objectives of this course are:</p> <ul style="list-style-type: none"> • To introduce students with basic knowledge of inorganic, organic and physical chemistry necessary for understanding the human body. • To apply the basic principles of molecular logic of biochemical processes in a living organism. • To present the relationship between the structure, chemical properties and functions of certain compounds in the living organism, and the rate and mechanisms of chemical reactions. • To recognize the integration of chemical, biochemical and physiological aspects in the body. • To introduce the students with classical and instrumental methods of chemical analysis. • To relate experimental results with chemical laws. <p>The acquired knowledge and skills provide a chemical basis for understanding the senior year subject Biochemistry.</p>
--	---

<p><i>Learning outcomes (general and specific competences):</i></p>	<ul style="list-style-type: none"> • Understand the basic physico-chemical processes that are necessary to understand biochemical and physiological processes. • Classify organic molecules important for the construction of biological macromolecules, and associate molecular properties (based on chemical structure) and mechanisms of chemical reactions. • Explain the chemical basis of biological processes. Understand the underlying clinical problems in terms of chemical changes. • Understand the principles and acquire the experimental basis of qualitative and quantitative chemical analysis.
--	---

Course content (Syllabus):	<p>The program consists of two parts: selected chapters of physical and organic chemistry (Intramolecular and intermolecular forces. Gases. Solutions. Buffers. Chemical thermodynamics. Electrochemical reactions. Chemical equilibrium. Kinetics of chemical reactions. Enzymatic kinetics. Nomenclature, properties and stereochemistry of selected organic compounds. Organic compounds through functional groups. Reactions of organic compounds. Bioorganic compounds. Qualitative and quantitative chemical analysis).</p> <p>The teaching process is realized through the lectures, seminars and laboratory exercises.</p>			
Format of instruction (mark in bold)	Lectures	Exercises	Seminars	Independent assignments
	Consultations	Work with Mentor	Field work	Other
	Notes: The teacher presents the theoretical material. Students independently scrutinize the assigned topic related to the issues of appropriate teaching units in the form of power-point presentations.			
Student responsibilities	The final exam, 2 continuous assessments, practical part of the output colloquium, attendance and participation in class, especially in problem solving during the seminar.			
Screening student work (mark in bold)	Class attendance	Class participations	Seminar essay	Practical training
	Oral exam	Written exam	Continuous assesment	Essay

Detailed evaluation within a <i>European system of points</i>			
STUDENTS RESPONSIBILITIES	HOURS	PROPORTIONS OF ECTS CREDITS	PROPORTION S OF MARK
Class attendance and participations	30	1	0%
Continuous assessment of knowledge (2x)	45	1,5	6%
Practical part of the output colloquium	30	1	1%
Written exam	110	4	93%
<p>Additional explanations:</p> <p>Since this is a basic course in a specific area of physical and organic chemistry, in addition to lectures, the processing of selected variety of seminar topics and solving tasks helps students to extend their knowledge and to show ability to think critically and to recognize the essential elements of a certain educational issues.</p> <p>In the final assessment, results of the final examination are included, as well as the activity during lectures, activities on practical training and success in the continuous assessment. For the exam access student is required to make all the other aforementioned obligations.</p> <p>Students have the option of the continuous assessment in stechiometry and organic chemistry to win a maximum of 10 points, which are added to the first partial exam in chemistry.</p> <p>The exam is written.</p> <p>Final exam and regular examination periods: To pass (on the final exam or regular examination period) student should achieve 55% or more points. The unique assessment at the exam is determined on average grade of two tests, continuous assessments (tests), activity during all forms of teaching.</p> <p>According to the Regulations on studying final grade is obtained as follows:</p> <p>A = 91 to 100% 5 (excellent)</p> <p>B = 79 to 90% 4 (very good)</p> <p>C = 67 to 78% 3 (good)</p> <p>D = 55 to 66% 2 (sufficient)</p> <p>F = 0 to 54% 1 (insufficient)</p>			

<i>Required literature:</i>	<ol style="list-style-type: none">1. K. J. Denniston, J. J. Topping, R. L. Caret, General, Organic, and Biochemistry, 4th Edition, McGraw Hill, New York, 2004.2. CD power point presentations3. Laboratory Manual for Medical Chemistry
<i>Optional literature:</i>	<ol style="list-style-type: none">1. P. W. Atkins and J. de Paula, Atkins' Physical Chemistry, 9th edition, Oxford University Press, 2010.2. P. W. Atkins and J. de Paula, Physical Chemistry For The Life Sciences, 2nd edition, Oxford University Press, 2011.3. D. J. Hart, C. M. Hadad, L. E. Craine, H. Hart, Organic Chemistry – A Short Course, 13th Ed, Brooks/Cole, Cengage Learning, Belmont, 2012.

Additional information about the course	<p>Monitoring methods of teaching quality:</p> <ul style="list-style-type: none"> - student questionnaire - quality analysis by students and teachers - exam results analysis - report of the office for teaching quality - external evaluation (visit of team for quality control)
--	--

ANNEXES: Calendar classes

The number of teaching units	TOPICS AND LITERATURE
I.	Title: Chemical bonding and intermolecular forces.
	Short description: Molecular structure and chemical bond, bioelements, chemical bonds between biomolecules, basic elements of living matter
	Literature: K. J. Denniston, J. J. Topping, R. L. Caret, General, Organic, and Biochemistry, 4th Edition, McGraw Hill, New York, 2004. Teaching materials.
II.	Title: Solutions
	Short description: Solutions. Water as the solvent. The distribution of the substance in solution. Electrolytes. The acids and alkalis. Buffers. Colligative properties. The osmotically active particles. Colloid-dispersed systems. Precipitation reactions. Colloids and macromolecules.
	Literature: K. J. Denniston, J. J. Topping, R. L. Caret, General, Organic, and Biochemistry, 4th Edition, McGraw Hill, New York, 2004. Teaching materials.
III.	Title: Chemical equilibrium.
	Short description: The influence of concentration, temperature and pressure on the chemical balance. The equilibrium constant and Gibbs energy. The reaction of isotherms. The compounds rich with energy. Metastable living system.
	Literature: K. J. Denniston, J. J. Topping, R. L. Caret, General, Organic, and Biochemistry, 4th Edition, McGraw Hill, New York, 2004. Teaching materials.
IV.	Title: Thermodynamics and thermochemistry.
	Short description: Thermodynamic Laws. Internal energy. Enthalpy. Entropy. Gibbs's energy. Energy of biological systems. Energy balance of biochemical systems.
	Literature: K. J. Denniston, J. J. Topping, R. L. Caret, General, Organic, and Biochemistry, 4th Edition, McGraw Hill, New York, 2004. Teaching materials.
V.	Title: Chemical kinetics.
	Short description: The speed of reaction. Order and molecularity reaction.

	Factors affecting the rate of reaction. Enzymes. Complex reactions.
	Literature: K. J. Denniston, J. J. Topping, R. L. Caret, General, Organic, and Biochemistry, 4th Edition, McGraw Hill, New York, 2004. Teaching materials.
VI.	Title: Electrochemistry. processes.
	Short description: Electrode potential and electrochemical cells. Gibbs energy of redox reactions. The biological redox systems.
	Literature: K. J. Denniston, J. J. Topping, R. L. Caret, General, Organic, and Biochemistry, 4th Edition, McGraw Hill, New York, 2004. Teaching materials.
VII.	Title: Introduction to Organic Chemistry. Alkanes and cycloalkanes. Stereochemistry.
	Short description: : Chemical bonds. The theory of molecular orbitals. Hybridization. The theory of acids and bases. Physical properties of organic compounds. Classification of organic compounds. The functional groups. Nomenclature. Alkanes, composition, constitution, isomerism. Configuration. Physical Properties. Conformational analysis. Stereoisomers: enantiomers and diastereomers. Chirality. Fisher projection formula. CIP system nomenclature. Optical activity.
	Literature: K. J. Denniston, J. J. Topping, R. L. Caret, General, Organic, and Biochemistry, 4th Edition, McGraw Hill, New York, 2004. D. J. Hart, C. M. Hadad, L. E. Craine, H. Hart, Organic Chemistry – A Short Course, 13th Ed, Brooks/Cole, Cengage Learning, Belmont, 2012. Teaching materials.
VIII.	Title: Alkenes and alkynes Aromatic compounds.
	Short description: Unsaturated hydrocarbons: alkenes and alkynes, structure and physical properties. E-Z isomerism. Electrophilic addition to alkenes. : Kekule-structure, resonant model and orbital model of benzene. Stability of benzene. Electrophilic aromatic substitution.
	Literature: K. J. Denniston, J. J. Topping, R. L. Caret, General, Organic, and Biochemistry, 4th Edition, McGraw Hill, New York, 2004. Teaching materials.
IX.	Title: The alkyl halides. Alcohols, ethers, thiols, sulfides. Aldehydes and ketones.
	Short description: Nucleophilic substitution at saturated carbon. Elimination reactions. Classification and physical properties of alcohol. Acidity strength. Disqualifying and susptitucijske reactions. Oxidation alkoholaBiološki important alcohols and phenols. Ethers and epoksidi.Tioli and sulphides. The nature of the carbonyl group. The nucleophilic addition to the carbonyl group. Oxidation and reduction of carbonyl compounds.
	Literature: K. J. Denniston, J. J. Topping, R. L. Caret, General, Organic, and Biochemistry, 4th Edition, McGraw Hill, New York, 2004. Teaching materials.
X.	Title: Amines. Heterocyclic compounds. Carboxylic acid and derivatives.
	Short description: Amines: structure and physical properties. Basicity of the amines. Heterocyclic compounds. a carboxyl group. Physical Properties. The acidity of the carboxylic acid. Synthesis of carboxylic acids. The carboxylic acid derivatives. Nucleophilic acyl substitution. Esther. Acid anhydrides. Acid chlorides. Amides.
	Literature: K. J. Denniston, J. J. Topping, R. L. Caret, General, Organic, and Biochemistry, 4th Edition, McGraw Hill, New York, 2004. Teaching materials.

<i>XI.</i>	Title: Carbohydrates. Nucleosides, nucleotides and nucleic acids. Amino acids and proteins. Lipids.
	Short description: Carbohydrates. Classification. Fisher's formula. Epimers. Redox reactions of monosaccharides. Straight-chain and cyclic forms. Anomeric carbon atom. Mutarotation. Haworth formula. Glycosides. Reducing and non-reducing sugars. Disaccharides. Polysaccharides. Nucleosides, nucleotides and nucleic acids. Amino acids. Relative configuration. Zwitterion. Peptide bond. Primary, secondary and tertiary protein structure. Enzymes. Lipids. Physico-chemical properties of lipids.

	peptide chains. Proteins. Primary, secondary, tertiary and quaternary structure of proteins. Enzymes. Lipids. Waxes. Fats and oils. Saturated and unsaturated fatty acids. Phospholipids. Sphingolipids. Prostaglandin. Terpenes. Steroids.
	Literature: