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| **NAME OF THE COURSE** | | **Medical Chemistry and Biochemistry I** | | | | | | | | | |
| **Code** | MFE | | | | | Year of study | | 1st | | | |
| Course teacher | Assoc. Prof. Vedrana Čikeš Čulić | | | | | Credits (ECTS) | | 8 | | | |
| Associate teachers | Prof. Anita Markotić, PhD  Assist. Prof. Nikolina Režić Mužinić, PhD  Assist. Prof. Marina Degoricija, PhD  Angela Mastelić, PhD  Sandra Marijan, PhD  Mirela Lozić, PhD | | | | | Type of instruction (number of hours) | | L | S | E | T |
| 34 | 14 | 42 | 90 |
| Status of the course | Mandatory | | | | | Percentage of application of e-learning | | 10% | | | |
| **COURSE DESCRIPTION** | | | | | | | | | | | |  | |
| Course objectives | The aim of the course Medical Chemistry and Biochemistry I is to provide basic knowledge about the chemical structure, properties and role of simple and complex biological compounds that make up the human body, chemical and energy changes and apply them to individual and overall biochemical processes. A thorough understanding of these principles should provide students with key biochemical concepts and principles that serve as the basis of knowledge, enabling them to better study and understand the complexities of the human body and the (patho) biochemical basis of disease. | | | | | | | | | | |  |
| Course enrolment requirements and entry competences required for the course | Not applicable | | | | | | | | | | |  |
| Learning outcomes expected at the level of the course (4 to 10 learning outcomes) | 1. Describe and explain the basics of chemical bonds and intermolecular forces between compounds, and analyze and apply the basic physical and chemical principles that apply to gases and solutions 2. Classify and describe structural characteristics, and list the biological roles of complex biomolecules (carbohydrates, lipids, proteins and nucleic acids). 3. Identify and explain the structures and reactions of inorganic and organic biological important compounds, including small, large and supramolecular structures that are located in the cell. 4. Explain and apply the principles of biochemical and energy changes, and laws of "current" balance in biological systems (homeostasis). 5. Identify redox reactions, the meaning of the potential of electrochemical processes and basics of energy with application to the reactions of catabolism and anabolism. 6. Describe the structure and role of biological membranes, the basics of substance transfer through membrane, and the structure and role of the extracellular matrix. 7. Explain the principles and mechanisms of enzyme-catalyzed reactions, importance of prosthetic groups and the impact of allosteric effectors on the structure and physiological protein function. 8. Develop basic laboratory skills, describe and apply qualitative and quantitative tests in the analysis of biologically significant inorganic ions and groups of organic compounds, and physical methods of separating microheterogeneous and homogeneous mixture (weighing, pipetting, titration, pH measurement, centrifugation, polarimetry, spectrophotometry, chromatographic separation of substances) | | | | | | | | | | |
| Course content broken down in detail by weekly class schedule (syllabus) | In parentheses is the number of hours referred to each topic.  **Lectures (L)**  L1 (2) Introduction into chemical basis of life. Atoms and elements.  L2 (2) Chemical bonds.  L3 (1) Free particles: the nature of gases.  L4 (1) Water and aqueosus solutions. Colligative properties of solutions.  L5 (2) Acids and bases. Buffer solutions.  L6 (2) Colloidal-dispersed systems.  L7 (2) Energy in transition: the first law of thermodynamics.  L8 (1) Reactions at equilibrium.  L9 (1) The rate of chemical change.  L10 (1) The natural direction of change: the second law of thermodynamics.  L11 (2) Chemical energy: electrochemistry.  L12 (2) Introduction to organic chemistry. Saturated and unsaturated hydrocarbons; physical and chemical properties. Isomers.  L13 (2) Alkenes. Stereochemistry.  L14 (1) Arenes. Haloalkanes; nucleophilic substitution, elimination.  L15 (2) Oxygen compounds. Aldehydes. Ketones.  L16 (2) Esters and compounds with nitrogen. Biomolecules.  L17 (1) Physiologically relevant carbohydrates and lipids.  L18 (1) Amino acids. Structure of proteins.  L19 (2) Globular proteins. Fibrous proteins.  L20 (2) Enzymes: mechanism of action, kinetics, regulation of activity  Globular proteins.  L21 (1) Structure of nucleotides and nucleic acids.  L22 (1) Membranes: structure and function.  **Seminars organic chemistry (SO)**  SO1 (3) Resonant structures. Isomers. Alkanes, alkenes, alkynes. Organic compounds with oxygen.  SO2 (3) Amines. Carboxylic acids. Amino Acids. Carbohydrates  **Seminar practicals (SP) and practicals (P)**  SP1+P1 (1+3) Basic stoichiometry. Preparation of solutions.  SP2+ P2 (1+3) Optical methods in medical chemistry.  SP3+ P3 (1+3) Gas laws. Ions in solution. Osmotic pressure.  SP4+ P4 (1+3) Volumetry: neutralization methods.  SP5+ P5 (1+3) Volumetry: oxidation and reduction method.  SP6+ P6 (1+3) Acids and alkalis, pH and buffers. SP7+ P7 (1+3) Energetics and kinetics of chemical reaction. SP8+ P8 (1+3) Qualitative analysis of some organic compounds.  P9 (3) Potentiometric titration of amino acids.  P10 (3) Serum proteins electrophoresis. P11 (3) Urease: determination of inhibitor. P12 (3) Alkaline phosphatase: effect of pH on enzyme activity.  P13 (3) Alkaline phosphatase: determination of Km and Vmax in the presence of inhibitors.  P14 (3) Integration of practicals - practical exam. | | | | | | | | | | |  |
| Format of instruction | ☒ lectures  ☒seminars and workshops  ☒ exercises  ☐ *on line* in entirety  ☐ partial e-learning  ☐ field work | | | | | ☐ independent assignments  ☐ multimedia  ☐ laboratory  ☐ work with mentor  ☐ (other) | | | | | |
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| Student responsibilities | In accordance to Rules of studying and Deontological code for USSM students. | | | | | | | | | | |
| Screening student work *(name the proportion of ECTS credits for each* *activity so that the total number of ECTS credits is equal to the ECTS value of the course)* | Class attendance | | 2 | Research |  | | Practical training | | | 2 | |
| Experimental work | |  | Report |  | | (Other) | | |  | |
| Essay | |  | Seminar essay |  | | (Other) | | |  | |
| Tests | | 2 | Oral exam |  | | (Other) | | |  | |
| Written exam | | 2 | Project |  | | (Other) | | |  | |
| Grading and evaluating student work in class and at the final exam | Written exam (Physical Chemistry, Organic Chemistry and Introduction to Biochemistry) and practical exam.  Exam terms:   1. 28.2.2023. 2. 24.7.2023. 3. 8.9.2023. 4. 22.9.2023. | | | | | | | | | | |
| Required literature (available in the library and via other media) | **Title** | | | | | | | **Number of copies in the library** | | **Availability via other media** | |
| 1. Atkins PW, de Paula J. Physical Chemistry, 10th edition. Macmillian Education, Oxford, 2014. | | | | | | | 1 | |  | |
| 2. Emine E. Abali, Susan D. Cline, David S. Franklin, Susan M. Viselli. Lippincott Illustrated Reviews: Biochemistry. 8th ed. Philadelphia, PA: Wolters Kluwer, 2021. | | | | | | | 5 | |  | |
| 3. Laboratory Manual of Medical Chemistry and Biochemistry I | | | | | | | Print office | |  | |
| Optional literature (at the time of submission of study programme proposal) | 1. Karen C. Timberlake. An Introduction to General, Organic and Biological Chemistry, 12th global edition, Pearson 2015.   1. Ferrier, Denise R. Lippincott Illustrated Reviews: Biochemistry. 7th ed. Philadelphia, PA: Wolters Kluwer, 2017. 2. Atkins PW, Clugston MJ. Principles of physical chemistry. Longman Group 1986, Sixth impression 1992. | | | | | | | | | | |
| Quality assurance methods that ensure the acquisition of exit competences | * Analysis of the quality of teaching by students and teachers * Analysis of passing exams * Reports of the Teaching Control Committee * Extra-institutional evaluation (visit of quality control teams of the National Agency for Quality Control, involvement in TEEP) | | | | | | | | | | |
| Other (as the proposer wishes to add) |  | | | | | | | | | | |