Lectures and practical exercises

Subject:	**Medical Chemistry**	**Code:**	*ULCHBKB/MCH-DM/22*
Study Programme:	*Dental Medicine*	**Study Period:**	*1. semester*
Evaluation:	*Exam*	**Subject Type:**	*compulsory*
Content:	*2 h lectures and 3 h practical exercises / week*		*Total 70 hours*

Workplace: **Department of Medical and Clinical Biochemistry, UPJŠ in Košice, FM**

Week	***Lectures*** https://portal.lf.upjs.sk/index-en.php	***Practical Lessons*** https://portal.lf.upjs.sk/index-en.php
1.	**INTRODUCTION TO MEDICAL CHEMISTRY** - Definition of terms - International (English) nomenclature - Properties of elements, micro- and macro-elements **WATER AND SOLUTIONS** - Water, properties and biological function of water - Disperse systems, properties of disperse systems - Solutions	**PRINCIPLES OF LABORATORY TECHNIQUE** - Laboratory safety rules - Equipment of laboratory bench - exercise: *Volume measurement*
2.	**BIOCHEMICAL REACTIONS PROCESS RULES I** - Kinetics of chemical reaction - Effect of reactant concentration, temperature on reaction rate. Order of reaction rate - Arrhenius, Brönsted-Lowry and Lewis theory - Autoprotolysis, H^+ exponent - pH of acids and bases. Buffer systems. Hydrolysis of salts - Equilibrium of a chemical reaction, equilibrium constant - Impact of factors on chemical equilibrium	**NOMENCLATURE OF INORGANIC COMPOUNDS (English)** **CALCULATIONS** - Stoichiometric calculations
3.	**BIOCHEMICAL REACTIONS PROCESS RULES II** - The basics of chemical thermodynamics - Internal energy, enthalpy, entropy - Gibbs free energy, chemical reaction spontaneity - Precipitation reactions, solubility equilibrium - Complexation reactions, complex formation Redox reactions, redox potential - Electrode potential of metals, Electrochemistry	**CALCULATIONS** - Solutions **VOLUMETRIC ANALYSIS** - exercise: *Standardization of NaOH solution*
4.	**ORGANIC CHEMISTRY I** - Alcohols and aldehydes - Carboxylic acids - Functional derivatives of carboxylic acids - Substitutional derivatives of carboxylic acids - Carbonic acid derivatives	**CALCULATIONS** - Calculation of pH of acid, base, and salt solutions **pH MEASUREMENT** - exercise: *Preparation and pH measurement of acetate buffers*
5.	**ORGANIC CHEMISTRY II** - Organic sulphur, phosphorus, nitrogen compounds, structure, and biological significance - 5-membered heterocycles with one or more heteroatoms - 6-membered heterocycles with one or more heteroatoms	**CALCULATIONS** - Calculation of buffers pH **BUFFER SYSTEMS** - exercise: *Effect of acids and bases on pH of buffers*
6.	**1st REVISION TEST** **ORGANIC CHEMISTRY III** - Biochemically and medicinally important derivatives of heterocyclic compounds (purines, pyrimidines, hormones, medicinal drug, dyes) - Heterocycles in drugs	**CALCULATIONS** - Balancing redox reactions **PROPERTIES OF ORGANIC COMPOUNDS** - exercise: *Preparation of esters of carboxylic acids*

Lectures and practical exercises

7.	**SACCHARIDES AND THEIR IMPORTANT DERIVATIVES** - The relationship between structure and biological properties of saccharides - Biologically important monosaccharides and their derivatives - Disaccharides and polysaccharides - Complex saccharides and their importance	**CALCULATIONS** - Spectrophotometric calculations **SPECTROPHOTOMETRY** - exercise: *Spectrophotometric determination of copper with ammonia*
8.	**LIPIDS AND STEROIDS** - Basic structure and classification of lipids - Fatty acids, their medical importance - Eicosanoids - Complex lipids - Steroids – classification, importance	**SACCHARIDES** - exercise: *Nitrochromium reaction* - exercise: *Seliwanoff's reaction* - exercise: *Tollen's reaction* - exercise: *Tollen's reaction (silver mirror)* - exercise: *Fehling's reaction* - exercise: *Lugol test*
9.	**AMINO ACIDS, PEPTIDES** - Classifications of amino acids, biochemical properties and their use in biochemistry - Amino acid derivatives and their biochemical significance - Peptides – structure, peptide bond, properties - Biochemically important peptides (e.g. glutathion)	**LIPIDS** - exercise: *Hydrolysis of neutral lipids by lipase* - exercise: *Detection of double bonds in fatty acids*
10.	**PROTEINS** - Spatial structure, classification, physical-chemical properties, biological and biomedical importance - Functional protein dispersity - Complex proteins and their function - Isolation methods and their use in medical practice	**AMINO ACIDS** - exercise: *Ninhydrin reaction* - exercise: *Xanthoprotein reaction* - exercise: *Foli's reaction* - exercise: *Determination of unknown protein*
11.	**NUCLEIC ACIDS** - Nucleotides and nucleosides - Biochemically important nucleotides with high energy hydrolysis - DNA and RNA - structure and biologic properties - Nucleic acid analysis techniques, their use in medical practice (restriction enzymes, PCR)	**PROTEINS** - exercise: *Reversible precipitation of proteins* - exercise: *Irreversible precipitation of proteins* - exercise: *Biuret reaction*
12.	**2nd REVISION TEST** **NATURAL COMPOUNDS, VITAMINS** - Terpenes, alkaloids and flavonoids - structure physical-chemical properties, biological significance - General properties of vitamins - structure and their importance in biochemistry (e.g. coenzymes) and in medicine	**NUCLEIC ACIDS I** - exercise*: Isolation of nucleoproteins from eukaryotic cells* - exercise*: Hydrolysis of nucleoprotein*
13.	**OXIDATIVE STRESS** - Biological importance of free ions in biosphere - Formation of oxygen and nitrogen radicals - Antioxidants	**NUCLEIC ACIDS II** - exercise: *Detection of nucleic acids components* **3rd REVISION TEST – practical exercises, seminars**
14.	**MEMBRANES AND TRANSPORT** - Structure of biological membranes - Membrane proteins - Transport of substances across biological membrane - Free diffusion, facilitated diffusion - Active transport, group translocation	**EVALUATION OF STUDENTS' WORK** - Final evaluation of practical exercises - Credit donation