Додаток 2
До Процедури розробки та періодичного перегляду освітніх програм

SYLLABUS OF THE ACADEMIC DISCIPLINE "MEDICAL CHEMISTRY"

1. General Information	
Faculty	Dentistry
Programme	22 Healthcare, 221 Dentistry, 2nd Master's degree of Higher education, full-time
Academic year	2023-2024
Subject	Medical chemistry, OK 8, kaf_genchemistry@meduniv.lviv.ua
Department	Department of General, Bioinorganic, Physical and Colloidal Chemistry, 52 Pekarska str., Lviv, 79010 Telephone: +38 (032) 2754987, Shymzeriv str. 3a, Lviv,79010 Telephone: +38 (032) 2786431, e-mail: kaf_genchemistry@meduniv.lviv.ua
Head of the Department	Iryna V. Drapak, PhD in Pharmacy, Assoc. Professor, e-mail: drapak_iryna@meduniv.lviv.ua
Year	1st year
Semester	I
Type of the Subject	obligatory
Professors	Olena Klenina, PhD in Pharmacy, Assoc. Professor, e-mail: olena_klenina@yahoo.com Marta Sulyma, PhD in Pharmacy, Assist. Professor, e-mail: sumarta145@gmail.com
Erasmus	No
Responsible for Syllabus	Oleksandra Roman, Assoc. Professor, e-mail: lesia_roman@ukr.net
Credits ECTS	3
Hours	90 Hours (Lectures – 14 hours, Practical classes – 32 hours, Individual work – 44 hours)
Language of	English

instruction	
Consultations	Consultations take place according to the approved schedule, both offline (face-to-face) and online, using ICT available to students and teachers
Address, telephone and regulations of the clinical base, office	-

2. Course overview

Medical chemistry is one of the fundamental natural sciences disciplines in higher medical education, the knowledge of its bases is essential for productive and creative work of experts in the field of health care. It develops the dialectical way of thinking, expands and deepens the scientific knowledges about matter, structure and properties of chemical compounds and the regularities of their interaction and transformation in living organism, and identifies the ways of applied problems solving in the health care sector.

The knowledges on medical chemistry will enable the future specialist to acquire skills most essential for qualitative and quantitative prediction of biochemical processes occurance probability and physicochemical principles of various types of equilibria in biological systems interpretation.

3. Course objectives

1. **The goal of the academic discipline** is the scientific outlook of students formation, the contemporary forms of their theoretical thinking development and the ability to analyze phenomena, the skills and abilities formation for the chemical and physico-chemical laws and processes application during the other disciplines studying and in future practical activities.

2. **Course objectives** – is to teach students to use the basic concepts of chemistry, the basic laws of chemistry, the general regularities of the chemical reactions proceeding, the theory of solutions, the general knowledge about chemical elements and their compounds, knowledge of the physico-chemical foundations of various types of equilibria in biological systems in solving specific problems in medicine in accordance to modern requirements..

3.General Competences:

1. the ability to abstract thinking, analysis and synthesis;
2. knowledge and understanding of the subject area and understanding of professional activity;
3. the ability to apply knowledge in practical situations;
4. the skills of information and communication technologies application;
5. the ability to search, process and analyze information from various sources.
6. ability to adapt and act in a new situation; ability to work independently;
7. The ability to identify, set and solve problems;
8. the ability to assess and ensure the quality of work.

Special (professional) competencies:

1. the ability to determine the required list of laboratory and instrumental studies and evaluate their results;
2. the ability to determine the nature of nutrition in the treatment of diseases;
3. to define tactics of emergency medical care provision on the basis of the urgent state diagnosis;
4. the ability to determine the principles and nature of the treatment of diseases;

5. the ability to assess the impact of the environment, socio-economic and biological determinants on the health of the individual, family, population.		
4. Prerequisites of the Course		
Medical chemistry as an academic discipline: Based on previously studied by students subjects in secondary school such as Chemistry, Elementary Mathematics and Physics. Knowledge of the theoretical material of medical chemistry is necessary for the further assimilation of knowledge physiology, pathophysiology, biological chemistry, general and molecular pharmacology and toxicology, hygienic disciplines and ecology.		
5. Results of the Course		
Results		
Code of the learning outcomes	**The content of the learning outcomes**	**Matrix of competencies**
Зн – knowledges Ум – skills АВ – independence and responsibility К – competence		ПР – program learning outcomes
Зн-1	to know the safety rules in the chemical laboratory	*ПР 3*
Зн-2	properties of solutions and the ways of their concentrations expressing;	*ПР 2, ПР 3*
Зн-3	know the concept of colligative properties of solutions	*ПР2, ПР3, ПР4*
Зн-4	know the basic principles of coordination theory	*ПР2, ПР3, ПР4*
Зн-5	know the nature of the interaction between atoms and methods of molecule formation	*ПР2, ПР3, ПР4*
Зн-6	know the classification and nomenclature of inorganic compounds;	*ПР2, ПР3, ПР4*
Зн-7	know the basic concepts and laws of chemistry, methods of their use to solve applied problems;	*ПР2, ПР3, ПР4*
Зн-8	know the Vernadsky biosphere concept;	*ПР2, ПР3, ПР4*
Зн-9	know the relationship between the constant and the degree of electrolytic dissociation;	*ПР2, ПР3, ПР4*
Зн-10	know the types of protolytic reactions;	*ПР2, ПР3, ПР4*
Зн-11	know the factors that affect the shift of hydrolysis equilibrium;	*ПР2, ПР3, ПР4*
Зн-12	know the properties of buffer solutions and their role in biosystems;	*ПР2, ПР3, ПР4*
Зн-13	know the classification and principles of titrimetric and physico-chemical methods;	*ПР 13, ПР14*
Зн-14	know the basic laws of chemical reactions of various types;	*ПР 15, ПР16*
Зн-15	know the basic concepts of chemical thermodynamics;	*ПР2, ПР3, ПР4*
Зн-16	know the basic laws of chemical thermodynamics;	*ПР2, ПР4, ПР5*
Зн-17	know the role of electrochemical phenomena in biological processes	*ПР2, ПР4, ПР5*

Зн-18	know and understand the essence of potentiometric determination of pH of solutions;	*ПР2, ПР4, ПР5*
Зн-19	know the importance of surface phenomena in biology and medicine;	*ПР2, ПР4, ПР5*
Зн-20	know the laws of adsorption of substances at the interface between liquid-gas and liquid-liquid;	*ПР2, ПР4, ПР5*
Зн-21	know the laws of adsorption of substances from solutions on a solid surface;	*ПР 2, ПР19*
Зн-22	know the basic methods of obtaining lyophobic sols, their structure and properties;	*ПР 2, ПР19*
Зн-23	know the concepts of kinetic (sedimentation) and aggregative stability of dispersed systems.	*ПР 2, ПР19*
Ум-1	be able to perform calculations and prepare solutions of a given percentage, molar and normal (molar equivalent concentration) concentration;	*ПР 2, ПР19*
Ум-2	be able to determine the isotonicity of solutions and the molecular weight of the substance on the basis of cryometric measurements;	*ПР 2, ПР19*
Ум-3	be able to write formulas of complex compounds and equations of complex formation reactions to understand the role of natural complex compounds in the life of **o**rganisms;	*ПР 2, ПР 3*
Ум-4	be able to determine the chemical elements of different groups using identification reactions;	*ПР 5, ПР 7*
Ум-5	be able to use the theoretical principles of chemical equilibrium to characterize the properties of the electrolyte, the electrolyte strength, solubility, concentration of hydrogen and hydroxyl ions;	*ПР 5, ПР 7*
Ум-6	be able to perform calculations related to the preparation of buffer solutions;	*ПР 8, ПР 9,ПР 10*
Ум-7	master the method of titrimetric determinations;	*ПР 11, ПР12*
Ум-8	be able to quantify the mass fraction of a substance by the method of neutralization;	*ПР 13, ПР14*
Ум-9	be able to determine experimentally the rate constants of chemical reactions and use them to characterize chemical processes;	*ПР 15, ПР16*
Ум-10	be able to perform thermochemical calculations to assess the caloricity of food and determine the thermal effects of chemical reactions and processes	*ПР 2, ПР19*
Ум-11	be able to measure the EMF of galvanic cells and electrode potentials using the compensation method	*ПР 2, ПР19*
Ум-12	master the method of determining the concentration of solutions of acids and bases by potentiometric titration;	*ПР 2, ПР19*
Ум-13	be able to apply the theoretical provisions of the theory of adsorption, to master the methods of studying adsorption at the liquid-gas boundary, liquid-liquid in the practice;	*ПР 2, ПР19*
Ум-14	be able to determine the surface tension at the liquid-gas interface by the Rebinder method and calculate the adsorption by the Gibbs equation;	*ПР 2, ПР19*

Ум-15	be able to determine the adsorption of substances from solutions by solid adsorbents (activated carbon, zeolites);	*ПР 2, ПР19*
Ум-16	be able to interpret the laws of adsorption of substances from solutions on a solid surface	*ПР 2, ПР19*
Ум-17	be able to write the chemical equation of the reactions to obtain colloidal particles and the formula of micelles;	*ПР 2, ПР19*
Ум-18	be able to determine the coagulation threshold of electrolytes, calculate the coagulation capacity of electrolytes and determine the protective number of the polymers.	*ПР 2, ПР19*
К-1	ability to apply knowledge in practical situations	*ПР 2, ПР19*
К-2	ability to abstract thinking, analysis and synthesis, ability to learn and be modernly trained	*ПР 2, ПР19*
К-3	knowledge and understanding of the subject area	*ПР 2, ПР 3*
К-4	ability to evaluate and ensure the quality of work	*ПР 5, ПР 7*
К-5	ability to organize activities for the preparation of solutions	*ПР 8, ПР 9,ПР 10*
К-6	ability to organize activities for planning and performing simple chemical experiments	*ПР 11, ПР12*
К-7	ability to apply knowledge in practical situations	*ПР 13, ПР14*
АВ-1	be responsible for making decisions in difficult conditions	*ПР 2, ПР 3*
АВ-2	be responsible for the timely acquisition of modern knowledge	*ПР 5, ПР 7*
АВ-3	be responsible for the quality of work	*ПР 8, ПР 9,ПР 10*
АВ-4	independence, responsibility	*ПР 11, ПР12*

6. Course format and content

Course format	**Full-time Course**	
Classes	Hours	Groups
Lectures	14	2
Practical	32	2
Seminars		-
Individual	44	2

7. Topics and content of the Course

Code of the classes type	**Topic**	**Content**	**Code of the learning outcomes**	**Professor**
Л – lecture П – practical class СРС – individual student's work				

П-1/Л-1/СРС-1	The ways of expression concentrations of solutions. Preparation the solution with known concentration. Solutions used as antiseptics for personal hygiene, as well as for disinfection in public and residential premises and buildings. Classification of disinfectants and antiseptics by the main active substances and their concentration in working solutions.	Role of solutions in the organisms life. Classification of solutions. Mechanism of dissolution processes. Thermodynamic approach to the process of the dissolution. The solubility of the substances. The solubility of gases in liquids. The dependence of the solubility of gases on the pressure (Henry-Dalton's law), nature of the gas and solvent, temperature. Effect of electrolytes on the solubility of gases (Sechenov's law). Solubility of gases in the blood. Decompression sickness. The solubility of liquids and solids in liquids. The dependence of solubility on temperature and the nature of the solute and solvent. Nernst law of distribution and its importance in the phenomenon of the permeability of biological membranes. The values that characterize the quantitative composition of solutions. Preparation of solutions of a given quantitative composition.	*Зн-1, Зн-2, Ум-1,К-1,К-2,К-3,К-4,К-5, К-6,К-7, АВ-1,АВ-2,АВ-3,АВ-4*	O.Klenina M.Sulyma
П-2/Л-1/СРС-2	Colligate properties of solutions. Experimental determination of the molecular mass of a solute, osmotic concentration of solutions with the cryometry method	Colligative properties of diluted nonelectrolytes solutions. Lowering of the vapor pressure of the solvent above the solution. Raoult's law. Ideal solutions. Depression of the freezing point of a solution and boiling point elevation of a solution. Osmosis and osmotic pressure. Vant' Hoff's law. Colligative properties of diluted electrolytes solutions. Isotonic coefficien. Hypo-, hyper- and isotonic solutions. Cryometry, ebuliometry, osmometry, and their use in biomedical researches. The role of osmosis in biological systems. Osmotic pressure of blood plasma. Haller equation. Oncotic pressure. Plasmolysis and hemolysis.	*Зн-1, Зн-2,Зн-3, Ум-2, К-1,К-2,К-3,К-4,К-5, К-6,К-7, АВ-1,АВ-2,АВ-3,АВ-4*	
П-3/Л-2/СРС-3	The equilibrium and processes with coordination compounds. Preparation and properties of complex and inner complex compounds. Complexonometry	Complex formation reactions. Werner coordination theory and modern understanding of the structure of complex compounds. The concept about complexing agent (central ion). Nature, coordination number, hybridization of central atom orbitals. The concept about ligands. Denticity of ligands. The inner and external spheres of the coordination compounds. Geometry of the complex ion. The nature of the chemical bond in complex compounds. Classification of complex compounds according to the charge on the inner sphere and the nature of ligands. Chelate compounds. Polynuclear complexes. Complexons and their application in medicine as antidotes to remove toxic metal	*Зн-1, Зн-2,Зн-4, Зн-5, Ум-3, К-1,К-2,К-3,К-4,К-5, К-6,К-7, АВ-1,АВ-2,АВ-3,АВ-4*	

		ions from the organism and as antioxidants at storage of drugs. Trilon B and eugenol in dentistry. The chemical composition of mineralized tooth and saliva tissues. Physical and chemical characteristics of saliva. Heterogeneous equilibria in the oral cavity. Chemical bases of mineralization of bone and dental tissue and method of remineralization. Application of fluoride drugs and toothpastes in dentistry.		
П-4/Л-2/СРС-4	Bio-elements in medicine and dentistry. Chemical properties and biological role of macroelements.	General information about nutrients. Qualitative and quantitative content of nutrients in the body. Macronutrients, micronutrients and impurity elements. Organogens. The concept of Vernadsky's doctrine about biosphere and the role of living matter (living organisms). Relationship between the content of biogenic elements in the human body and its contents in the environment. Endemic diseases and their connection with the peculiarities of biogeochemical provinces (regions with a natural deficiency or excess of certain chemical elements in the lithosphere). Problems of biosphere pollution and purification because of toxic chemicals. Electronic structure and electronegativity of *s*- and *p*- elements. Typical chemical properties of *s*-, *p*-elements and their compounds (reactions without changing of oxidation state. The relationship between the location of s-and p-elements in the periodic table and their content in the body. Uses in medicine. Toxic effects of compounds. Reactions of identification of CO_3^{2-}, SO_4^{2-}, NO_2^-, $S_2O_3^{2-}$ ions	*Зн-1, Зн-6,Зн-7, Зн-8, Ум-4, К-1,К-2,К-3,К-4,К-5, К-6,К-7, АВ-1,АВ-2,АВ-3,АВ-4*	
П-5/Л-2/СРС-5	Chemical properties and biological role of microelements.	The metals of life. Electronic structure and electronegativity of d-elements. Typical chemical properties of d-elements and their compounds (reactions with oxidation numbers changing, complex formation reactions). Their biological significance. Uses in medicine. Toxic effects of d-elements and their compounds. Metals and alloys in dentistry and requirements they should meet. Alloys and amalgams of gold, silver and copper in dental practice. Chromium-nickel and chromium-cobalt stainless steel. Auxiliary materials in orthopedic dentistry. Blemish materials: dental gypsum, tar acids, gentian paste. Forming materials. Dental fill materials: phosphate cements (zinc phosphate, bactericidal, silicophosphate); price-sensitive genol, zinc-polycarboxylate, ionomer cements. The chemistry of stubble cements	*Зн-1, Зн-6,Зн-7, Зн-8, Ум-4, К-1,К-2,К-3,К-4,К-5, К-6,К-7, АВ-1,АВ-2,АВ-3,АВ-4*	
П-6/Л-3/СРС-6	Acid-base equilibrium. Calculation and experimental determination of the pH of biological liquids. Protolytical processes in living	Electrolyte solutions. Electrolytes in the human body.The degree and the dissociation constant of weak electrolytes. Properties of solutions of strong electrolytes. Activity and activity coefficient. Ionic force of solution. Water and electrolyte balance - a necessary condition for homeostasis. Dissociation of water. Ionic product of water. pH. The pH values for different liquids of the human body in normal and pathological conditions. Theories of acids and bases. Types of protolytic reactions: neutralization, hydrolysis and ionization. Hydrolysis of salts. The degree of a hydrolysis, its	*Зн-1, Зн-9,Зн-10, Зн-11, Ум-5, К-1,К-2,К-3,К-4,К-5, К-6,К-7, АВ-1,АВ-2,АВ-3,АВ-4*	

	organisms.	dependence on concentration and temperature. Constant of a hydrolysis. The role of hydrolysis in biochemical processes.		
П-7/Л-3/СРС-7	Properties of buffer solutions and their role in biological systems. Preparation of buffer solutions. Determination of the buffer capacity.	Buffer solutions and their classification. Henderson-Hasselbach equation. Mechanism of buffer action. Buffer capacity. Buffer systems of the blood. Bicarbonate (hydrogencarbonate) buffer, phosphate buffer. Protein buffer systems. The concept of acid-base condition of blood	*Зн-1, Зн-12, Ум-5, Ум-6, К-1,К-2,К-3,К-4,К-5, К-6, К-7, АВ-1,АВ-2,АВ-3,АВ-4*	
П-8/Л-3/СРС-8	The basic principles of the titrimetric analysis. Acid-base titration.	Principles of titrimetric analysis. The method of acid-base titration. Choice of indicators for various types of acid-base titration.	*Зн-1, Зн-13, Зн-14, Ум-1, Ум-7, Ум-8, К-1,К-2,К-3,К-4,К-5, К-6,К-7, АВ-1,АВ-2,АВ-3,АВ-4*	
П-9/Л-4/СРС-9	Chemical thermodynamics. The direction of chemical and biochemical processes proceeding.	The special fields of chemical thermodynamics. Basic terms of chemical thermodynamics: thermodynamical system (isolated, closed, open, homogeneous, heterogeneous), the state variables (extensive and intensive), thermodynamical processes (reversible, irreversible). Living organisms as open thermodynamical systems. Irreversibility of life processes. The first law of thermodynamics. Enthalpy. Thermochemical equations. Standard enthalpies of formation and combustion. Hess's law. Calorimetry techniques. Biochemical processes energetic characteristics. Thermochemical calculations for the foods fuel capacity (caloricity) evaluation and making rational and therapeutic diets. Spontaneous and non-spontaneous processes. The second law of thermodynamics. Entropy. Thermodynamic potentials: Gibbs' free energy, Helmholtz' free energy. Termodynamical equilibrium conditions. The criteria for the spontaneous processes direction. The basic principles of thermodynamics applying to living organisms. ATP as an energy source for biochemical reactions. Macroergic compounds. Energetical conjugations in living systems: exergonic and endergonic processes in the organism.	*Зн-1, Зн-15, Зн-16, Ум-9, Ум-10, К-1,К-2,К-3,К-4,К-5, К-6,К-7, АВ-1,АВ-2,АВ-3,АВ-4*	
П-10/Л-5/СРС-10	Kinetical regularities of biochemical processes proceeding. Precipitation and dissolving reactions.	Chemical kinetics as the basis for the rates and mechanism of biochemical reactions studying. The reaction rate. Concentration affection the reaction rate. The law of mass action for the reaction rate. Rate constant. The reaction order. Kinetical equations for zero-, first- and second-order reactions. Half-life. Half-time od decomposition as quantitative characteristic of changes in the concentration in the environment of radionuclides, pesticides, etc. The reaction mechanism concept and the reaction molecularity. The temperature influence the reaction rate. Van't Hoff's rule. Features of the temperature coefficient of the reaction rate for the biochemical processes.	*Зн-1, Зн-14, Ум-9, Ум-10, К-1,К-2,К-3,К-4,К-5, К-6,К-7, АВ-1,АВ-2,АВ-3,АВ-4*	

		Activation energy. Collision theory. Arrhenius equation. The concept of the transition state theory. The kinetics of complex reactions: parallel, successive, conjugated, reversible, chain. The concept of antioxidants. Free radical reactions in living organisms. Photochemical reactions, photosynthesis. Catalysis and catalysts. Features of catalysts. Homogeneous, heterogeneous and microheterogeneous catalysis. Acid-base catalysis. Autocatalysis. The mechanism of catalytical action. Promoters and catalytic poisons. The kinetics of enzymatic reactions. Enzymes as biological catalysts. Enzymes features: selectivity, efficiency, temperature and reaction medium affections. The concept of the enzymes action mechanism. Dependence of enzymatic processes rate on the concentration of enzyme and substrate. Activation and inhibition of enzymes. The impact of environmental factors on the kinetics of enzymatic reactions. Chemical equilibrium. Equilibrium constant and its expression. Chemical equilibrium shifting at change of temperature, pressure, concentration of substances. Le Chatelier principle. Precipitation and dissolving reactions. Solubility product constant. Precipitates formation conditions. The heterogeneous equilibrium role in general homeostasis of the organism.		
П-11/ СРС-11	Measuring the electrical driving force of electrochemical elements and electrodes potentials	The electrochemical phenomena significance for biochemical processes. Electrodes potentials and their origin mechanisms. Nernst equation. The standard electrode potential. The standard hydrogen electrode.Half-cells potentials measurement. Indicator electrodes and reference electrodes. Silver-silver chloride electrode. Ion-selective electrodes. Glass electrode. Galvanic (electrochemical or voltaic) cells.	*Зн-1, Зн-17, Ум-11, К-1,К-2,К-3,К-4,К-5, К-6, К-7, АВ-1,АВ-2,АВ-3,АВ-4*	
П-12/СРС-12	Measuring the red-ox potentials. Potentiometry determination of pH. Potentiometry titration.	Redox reactions significance for biochemical processes. Redox potential as a measure of the half-cell tendency to act as oxidizing or reducing agent. Peters' equation. A standard redox potential. The spontaneity and the direction of redox reaction proceeding prediction by their redox potentials values. Equivalent factors of reduction and oxidizing agents. Redox potentials role for the biological oxidation mechanism. The fundamentals of potentiometry method. Electrochemical processes in the oral cavity. Protective films..	*Зн-1, Зн-17, Зн-18, Ум-11, Ум-12, К-1,К-2,К-3,К-4,К-5, К-6, К-7, АВ-1,АВ-2,АВ-3,АВ-4*	
П-13/Л-6/СРС-13	Adsorption on the mobile interphases. The determining of the surface tension of solutions and	Surface phenomena and their importance in biology and medicine. Surface tension of liquids and solutions. Isotherm of surface tension. Surfactants and surface-inactive substance. Surface activity. Duclo's-Traube rule. Adsorption at the liquid-gas and liquid-liquid interfaces. Gibb's equation. The orientation of the surfactants molecules in the surface layer. The concept of the	*Зн-1, Зн-19, Зн-20, Ум-13, Ум-14, Ум-15, К-1,К-2,К-3,К-4,К-5, К-6, К-7, АВ-1,АВ-2,АВ-3,АВ-4*	

	biological liquids. Surface tension and adsorption isotherms\	structure of biological membranes		
П-14/Л-6/СРС-14	Molecular adsorption of the surface of a solid. Adsorptive processes and ions exchange in bio-systems. Chromatography	Adsorption at the solid-gas interface. Langmuir equation. Adsorption from solution at the solid-liquid interface. Physical sorption (or physisorption) and chemical sorption (or chemisorption). General rules for the solutes, vapours and gases adsorption. Freundlich equation. Physico-chemical basis of adsorption therapy (hemosorbtion, plazmosorbtion, limfosorbtion, enterosorption, application therapy). Immunosorbents. Adsorption of electrolytes: specific (selective) and ion exchange. Fajans-Peneth precipitation and adsorption rule. Naturally occurring ion exchangers and synthetically produced organic resins. Adsorption and ion exchange significance for the vital process in plants and living organisms. Chromatography. Chromatographic methods of analysis classification based on the phases states of matter, the technique and the separation mechanism. Adsorption, ion exchange and distribution chromatography. Chromatography applications in biology and medicine	*Зн-1, Зн-19, Зн-21, Ум-13, Ум-14, Ум-15, Ум-16, К-1,К-2,К-3,К-4,К-5, К-6, К-7, АВ-1,АВ-2,АВ-3,АВ-4*	
П-15/Л-7/СРС-15	Preparation, purification and properties of colloidal solutions	The living organism as a disperse systems combination. Classification of disperse systems according to the aggregative state, interphase interaction, dispersion. Lyophilic and lyophobic dispersions. A structure of micelle. Structure of a double electric layer (DEL). The overall performance and history of development the ideas about DEL structure. Electrokinetial potential of a colloidal particle. Methods of preparation and purification of colloidal solutions. Dialysis, electro-dialysis, ultrafiltration, compensatory dialysis. Haemodialysis and “artificial kidney” device. Molecular-kinetic properties of dispersions. Thermal molecular motion and Brownian motion, diffusion, and osmotic pressure. Optical properties of dispersions. Electrocinetical phenomena. Electrophoresis. Helholtz-Smoluchovsky’s equation. Application of electrophoresis in research, clinical and laboratory practice. Electrophoregrams. Disperse systems with gaseous dispersion medium. Classification of aerosols, methods of preparation and properties. The use of aerosols in clinical and sanitary practices. Toxic effect of some aerosols. Powders. Coarse systems with liquid dispersion medium. Suspensions, methods of preparation and properties. Pastes, their medical use. Emulsions, methods of preparation and properties. Types of emulsions. Emulsifiers. The use of emulsions in clinical practice. The biological role of emulsification. Semi colloidal soaps, detergents. Micelle formation in semi colloids solutions	*Зн-1, Зн-22, Ум-17, К-1,К-2,К-3,К-4,К-5, К-6, К-7, АВ-1,АВ-2,АВ-3,АВ-4*	
П-16/Л-7/СРС-16	Electrolytic	Kinetic (sedimentation) and aggregative stability of disperse systems. The reasons	*Зн-1, Зн-22, Зн-23, Ум-17,*	

	coagulation of colloids. Physico-chemistry of biopolymer solutions	of colloidal stability. Coagulation. The mechanism of electrolytes coagulating action. Coagulation threshold or critical concentration of coagulation. Schulze-Hardy rule. Mutual coagulation of sols. Coagulation proceedings for the potable water and wastewater purification. Colloidal protection. Macromolecular compounds as the basis of living organisms. Globular and fibrillar structure of proteins. Macromolecular solutions features and their similarities and differences with true and colloidal solutions. Swelling and dissolution of polymers. The mechanism of swelling. Swelling affecting with pH, temperature and electrolytes nature. The role of swelling in the organism physiology. Gels creation in polymers solutions. The mechanism of gels formation. The influence of pH, temperature and electrolytes presence on the gels formation rate. Thixotropy. Syneresis. Diffusion in gels. Salting out effect of biopolymers. Coacervation and phase separation and its role in biological systems. Anomalous viscosity of polymers solutions. The viscosity of the blood. Donnan membrane equilibrium. Isoelectric state of proteins. Isoelectric point and its determining methods. Ionic state of biopolymers in aqueous solutions.	*Ум-18, К-1,К-2,К-3,К-4,К-5, К-6, К-7, АВ-1,АВ-2,АВ-3,АВ-4*	

8. Verification of results

Current control

Is realized during the practical classes and aims at checking the learning of educational material.

The form of the current control assessment during the classes is defined by syllabus of discipline. Forms of current educational activities assessment are standardized and include the control of theoretical and practical training. The 4-point (traditional) scale is used in evaluating the learning of each topic for current educational activity taking into account the approved evaluation criteria.

Learning outcome code	Code of classes type	The method of learning outcomes verification	Criteria of evaluation
Зн-1, Зн-2, Зн-3, Зн-4, Зн-5, Зн-6, Зн-7, Зн-8, Зн-9, Зн-10, Зн-11, Зн-12, Зн-13, Зн-14, Зн-15, Зн-16, Зн-17, Зн-18, Зн-19, Зн-20, Зн-21, Зн-22, Зн-23, Ум-2, Ум-4,	П-1,Л-1,СРС-1, П-2,Л-1,СРС-2, П-3,Л-2,СРС-3, П-4, Л-2,СРС-4, П-5, Л-2,СРС-5, П-6,Л-3,СРС-6, П-7,Л-3,СРС-7, П-8,Л-3,СРС-8, П-9,Л-4,СРС-9, П-10,Л-5,СРС-10, П-11, СРС-11, П-12,СРС-12, П-13,Л-6,СРС-13, П-14,Л-6,СРС-14, П-15,Л-7,СРС-15, П-16/Л-7/СРС-16	The current control is a regular check of educational trained achievements, spent by the teacher on current employment according to syllabus of the discipline. It is performed at each practice class according to specific objectives. Theoretical students' self-preparation control is performed in writing by answering 18 multiple choice questions in the form one-of-five, the correct answer to each is estimated at 1 point, and two numerical problems, the correct solving being estimated at 2 points.	The minimum number of points that a student must gain for the crediting the theoretical part is 9 points

Ум-5, Ум-6, Ум-7, Ум-8, Ум-10, Ум-11, Ум-13, Ум-16, Ум-17, Ум-18, Ум-19, Ум-40, К-1, К-2, К-3, К-4, К-5, К-6, К-7, АВ-2, АВ-4			
Ум-1, Ум-2, Ум-3, Ум-4, Ум-5, Ум-6, Ум-7, Ум-8, Ум-9, Ум-10, Ум-11, Ум-12, Ум-13, Ум-14, Ум-15, Ум-16, Ум-17, Ум-18, К-1, К-2, К-3, К-4, К-5, К-6, К-7, АВ-1, АВ-2, АВ-3, АВ-4	П-1,Л-1,СРС-1, П-2,Л-1,СРС-2, П-3,Л-2,СРС-3, П-4,СРС-4, П-5,СРС-5, П-6,Л-3,СРС-6, П-7,Л-3,СРС-7, П-8,Л-3,СРС-8, П-9,Л-4,СРС-9, П-10,Л-5,СРС-10, П-11, СРС-11, П-12,СРС-12, П-13,Л-6,СРС-13, П-14,Л-6,СРС-14, П-15,Л-7,СРС-15, П-16/Л-7/СРС-16	The practical skills gained and the laboratory experiments carrying out assessment is performed after the laboratory work fulfilling by assessing the quality and fullness of its performance, the ability to interpret the obtained results. For the practical part of the lesson the student can get: - 4 points if laboratory work is completely fulfilled and the student correctly explains the experiments interpret the results and make conclusions; - 2 points if the laboratory work is done with some errors, the student can not fully explain and summarize the obtained results; - 0 points if the laboratory work is not performed or the student can not explain and summarize the obtained results.	The minimum number of points that a student must gain for the crediting the theoretical part is 9 points

Final control	
General evaluation system	The maximal assessment of current progress in a semester makes 60 % from a final assessment of knowledge on discipline, and the maximal assessment of examination makes 40 % from a final assessment of knowledge on discipline.
Grading scales	Traditional 4-point scale, multi-point (200-point) scale, ECTS rating scale.
Conditions of admission to the final control	The student attended all practical classes and received at least 72 points for current performance.

Exam	Semester exam – a form of final control of mastering of student theoretical and practical material from academic discipline. The final control is carried out in the form of a written exam, using the Misa training platform, according to the schedule. It lasts for 2 academic hours. It should be performed in writing as 80 MCQs (multiple choice questions: 1 point for each correct answer).	*Maximum quantity of points* – 80 points (1 point for each MCQ task); *Maximum quantity of points, which the student can collect on the exam makes 80 points.* *Minimum quantity of points on the exam – not less than 50.*

The highest possible score points which a student can gain for the current educational activity for the semester for admission to the exam is 120 points.
Minimal number of score points which a student must gain for current educational activity for the semester for admission to the exam is 72 points.
Calculation of the points number is based on grades gained by student under the traditional scale (by calculation of the arithmetic mean (*AM*) rounded to two decimal places). The resulting value is converted into points by multi-points scale as follows:

$$x = \frac{\text{CA} \times 120}{5}$$

9. Course policy

The policy of the course is determined by the system of requirements for the student in the study of the discipline "General and Inorganic Chemistry" and is based on the:
Regulations of the educational activity (https://cutt.ly/3ySk64r);
Regulations of the evaluation criteria (https://cutt.ly/lySlyw0);
Regulations of the academic integrity (https://cutt.ly/EySkNHu))

10. Recommended literature

Required course textbooks:

1. V.O. Kalibabchuk, V.I. Halynska, L.I. Hryshchenko et al. Medical Chemistry. – AUS MEDICINE Publishing. – 2010. – 224 p.
2. Raymond Chang. Chemistry (6th Edition). – WCB/McGraw-Hill. – 1998. – 995 p.
3. Steven S. Zumdahl. Chemistry (4th Edition). – Houghton Mifflin Company. – 1997. – 1031 p.
4. Gary L. Miessler, Donald A. Tarr. Inorganic Chemistry. – Prentice Hall. – 1991. – 625 p.

Additional books:

1. Rodney J. Sime Physical Chemistry. Methods. Techniques. Experiments. – Saunders College Publishing. – 1990. – 806 p.
2. John McMurry, Robert C. Fay. Chemistry (3rd Edition). – Prentice Hall. – 2001. – 1067 p.
3. David E. Goldberg. Fundamentals of Chemistry (2nd Edition). – WCB/McGraw-Hill. – 1998. – 561 p.
4. Theodore L. Brown, H.Eugene LeMay, Bruce E. Bursten. Chemistry. The Central Science. – Prentice Hall. – 2000. – 1017 p.
5. John Olmsted III, Gregory M. Williams. Chemistry. The Molecular Science. – Mosby. – 1994. – 977 p.

11. Equipment, material, technical and software support of the Course

Methodological support:
-Working program of the discipline;
- Multimedia support of lectures
- Lecture thesis from the discipline;
- Methodical recommendations for teachers;
- Educational platform Misa;
- Methodical recommendations for practical classes for students;
- Methodical manual for students' independent work;
- Test and control tasks for practical classes;
- Questions and tasks for final control (exam).

The department is provided with rooms for practical classes and control activities on the discipline in small groups. Laboratories are equipped with the necessary chemical utensils, reagents, devices.

12. Additional Information

Responsible for the educational process at the department – Associate Professor Volodymyr Rogovyk, rohovyk@i.ua
There is a scientific students' association at the department.
During the lectures and practical classes students must have laboratory coats and hats.
Practical classes are held in the classrooms of the department at the address: 52 Pekarska street, 2nd floor and 3a Shimzeriv street, Theoretical building, 4th floor.
Department website: https://cutt.ly/VyLt4BL

The Syllabus was developed by:

O.M. Roman, PhD in Pharmacy, Assoc.Prof. _____ _____

M.I. Sulyma, PhD in Pharmacy, Assist.Prof. _____ _____

Head of the Department

I.V. Drapak, PhD in Pharmacy, Assoc.Prof. _____ _____