

**PRIVATE HIGHER EDUCATIONAL INSTITUTION  
"INTERNATIONAL ACADEMY OF ECOLOGY AND MEDICINE"  
Department of Fundamental Disciplines**

**WORKING PROGRAM OF EDUCATIONAL DISCIPLINE**

**" Clinical Biochemistry"**

**LEVEL OF HIGHER EDUCATION** Second (master's) level

**DEGREE OF HIGHER EDUCATION** Master's degree

**BRANCH OF KNOWLEDGE** 22 Healthcare

**SPECIALTY** 222 Medicine

Reviewed and approved  
at the meeting of the Academic Council  
Protocol No. 1, dated August 01, 2017

**Kiev 2017**

Working program of education discipline "Clinical Biochemistry for the preparation of students of higher education of the second (master's) level of higher education in specialty 222 Medicine.

### INTRODUCTION

The study program of the academic discipline "Clinical Biochemistry" is compiled for students of the 4th year of the field of knowledge 22 "Health care" specialty 222 "Medicine"

#### Description of the academic discipline

Name of indicators	Field of knowledge, direction of training, educational qualification level	Characteristic academic discipline
		Full-time teaching
Number of credits 3	Branch of knowledge 22 "Health care"	Full course
	Specialty : 222 "Medicine"	
Modules 1	<b>Qualifications of the educational "Master of Medicine"</b>	A year of training
Content modules 2		IV
ECTS credits - 3.0		Semester
the total number of 90 hours		VII, VIII
	<b>Form of education:</b> daytime  <b>Type of discipline:</b> elective	Lectures
		<b>10 hours</b>
		Practical
		<b>10 hours</b>
		Laboratory
		<b>10 hours</b>
		Individual work
		<b>60 hours</b>
		Type of control:
		<b>Diff. settlement</b>

The discipline of Clinical Biochemistry entails development of fundamental concepts and skills in clinical biochemistry along with a focus on specialized areas of biomedical study.

This program aims to assist graduate students with bachelor degrees in sciences and clinical laboratory sciences to hone their knowledge and gain more experience in the field of clinical biochemistry.

It consists of substantial theoretical and practical sessions in order to strengthen the student's knowledge with clinical biochemistry professionalism. In the first block, the theoretical sessions represent 60-70% of the block time supported by 30-40% practicum. In the second block more practical sessions (50%) will be conducted supported by case studies. Practical and laboratory work sessions will increase during the third block in addition to more advanced case studies and theoretical and practical sessions in the laboratory

management. Ninety percent of the fourth block will be dedicated to hands-on training in the Clinical Biochemistry with more advance case studies related to bench work and laboratory management.

The typical work activities that student might undertake include:

- **planning and organising work in clinical biochemistry laboratories**
- **carrying out complex analyses on specimens of body fluids and tissues**
- **assuring the quality of clinical biochemistry investigations**
- **auditing the diagnostic and clinical use and performance of investigations**
- **developing new and existing tests, often automated and computer assisted but sometimes requiring considerable manual expertise**
- **liaising with clinical and other healthcare staff, often in a multidisciplinary team setting**
- **some patient contact**
- **writing reports**
- **submitting funding bids and conducting research with clinicians**

Clinical Biochemistry is a discipline where biochemical measurements are used to assist in the diagnosis, treatment, monitoring, and prevention of disease. Virtually every hospital in-patient or out-patient will require a biochemistry investigation. Many patients require multiple investigations, serial testing and emergency investigations. General practitioners are also making increasing use of the service.

#### **Course description (abstract)**

The course "Clinical Biochemistry" is taught to fourth-year university graduates within one semester. The course credits 3.0 ECTS credits –90 hours (30 classroom and 60 hours of independent work). The discipline program is structured into a module, which consists of 2 content modules. The amount of student workload is described in ECTS credits - credit credits that are credited to students upon successful completion of the corresponding module (credit credit). The discipline "Clinical Biochemistry" is included in the elective part of the curriculum for the preparation of full-time students of the educational level "Master".

The subject of study of the course "Clinical Biochemistry" is the study of metabolic processes in the human body in normal and pathology to assess the state of health, diagnosis and elucidation of the mechanism of disease development, its prognosis and appropriate pharmaco-correction.

Interdisciplinary Links: Clinical biochemistry as a discipline is based on the integration of, and integrates with, these disciplines from pharmacists, higher education of biological chemistry, functional biochemistry, physico-chemical and organic chemistry, botany, physiology and anatomy medical and analytical toxicology and biopharmacy, which involves the integration of teaching with these disciplines and the development of skills to apply knowledge of clinical biochemistry in the process of further training and professional activities.

#### **The purpose and objectives of the discipline**

The purpose of teaching the course "Clinical Biochemistry" is to train specialists who have a considerable amount of theoretical and practical knowledge regarding the nature of metabolic processes occurring in the human body in normal, pathological and in terms of therapeutic drugs; formation of knowledge about modern methods used in laboratories of clinical biochemistry; formation of knowledge about clinical and biochemical criteria of the state of the main types of metabolism; formation of modern notion of norm in clinical and biochemical research; training of interpretation of results obtained on the basis of methods of clinical

biochemistry; the development of knowledge, skills and competences that would ensure understanding between the doctor and the physician in their overall rational drug therapy activities; formation of knowledge on organization of work of laboratories of clinical biochemistry; formation of knowledge on measures of providing pharmaceutical care of the patient.

**The main tasks of studying the discipline "Clinical Biochemistry"** are the application of acquired knowledge and research results to create promising scientific programs; providing theoretical and practical basis for the study of medical and biological disciplines: pharmacology, pharmacotherapy, clinical pharmacology and others; formation of knowledge about the basics of biosafety and bioethics in Ukraine.

#### **Competences and learning outcomes facilitated by discipline**

The discipline provides students with competencies:

integral:

- Ability to solve typical and complex specialized problems and practical problems in professional pharmaceutical activity with application of provisions, theories and methods of fundamental, chemical, technological, biomedical and socio-economic sciences; integrate knowledge and solve complex issues, formulate judgments with insufficient or limited information; clearly and unambiguously communicate their findings and knowledge, reasonably substantiating them, to a professional and non-professional audience.
- Ability to think abstractly, analyze and synthesize, to be able to learn and to be modernly taught; knowledge and understanding of the subject area and understanding of the profession; ability to apply knowledge in practical situations; the ability to conduct research at an appropriate level; ability to evaluate and ensure the quality of work performed; skills of using information and communication technologies; ability to adapt and act in a new situation; the ability to act socially responsible and civilly conscious.
- Ability to analyze the correspondence of the structure of biomolecules to biochemical functions performed in a living organism; ability to explain the biochemical and molecular basis of physiological functions of cells, organs and systems of the human body; the ability to interpret the results of laboratory tests to explain the biochemical mechanisms of pathological processes in the human body and the principles of their correction with medicines; the ability to ensure the rational use of prescription and over-the-counter drugs according to the biochemical features of a particular disease.

Specification of competencies according to the NRC descriptors in the form of the Competence Matrix.

Classification competences for the NQF	Knowledge	Skill	Communication	Autonomy and responsibility
<b>Integral competence</b>				
Ability to solve typical and complex specialized problems and practical problems in professional pharmaceutical activity with application of provisions, theories and methods of fundamental, chemical, technological, biomedical and socio-economic sciences; integrate knowledge and solve complex issues, formulate judgments with insufficient or limited information; clearly and unambiguously communicate				

their findings and knowledge, reasonably substantiating them, to a professional and non-professional audience.

<b>General competencies</b>				
Ability to act socially responsible and civilly conscious.	Know your social and civil rights and responsibilities.	Know student social and community rights and responsibilities.	Ability to convey student social and social position.	Be responsible for student's civic position and activities.
Ability to apply knowledge in practical situations.	Know the methods of implementing knowledge in solving practical issues.	Be able to use professional knowledge to solve practical situations.	Establish contacts with practitioners.	Be responsible for the timeliness of the decisions made.
The desire to preserve the environment.	Know the problems of environmental protection, the requirements of the sanitary and hygiene regime and the conditions of labor protection.	Be able to formulate requirements for environmental protection, compliance with sanitary and hygiene regime and working conditions; interpret the requirements of legislative and regulatory acts on labor protection; to make conclusions about the presence of harmful factors of influence during the performance of professional duties; to provide protection of work of pharmaceutical personnel.	Develop measures for the conservation and protection of the environment.	Be responsible for implementing environment all conservation measures within the scope of its competence.
Ability to think abstractly, analyze and synthesize; the ability to learn and to be modernly trained	Know the current trends of the industry and analyze them.	Be able to analyze professional information, make informed decisions, and acquire up-to-date knowledge.	Make the right connections to meet student goals.	Be responsible for the timely acquisition of modern knowledge.
Knowledge and	Know the	Be able to perform	To form a	Be responsible

understanding of the subject area and understanding of the profession.	structure and features of professional activity	professional activities that require updating and integration of knowledge	communication strategy in professional activity	for professional development with a high level of autonomy
The ability to adapt and act in a new situation.	Know the elements of industrial and social adaptation; factors for successful adaptation to a new environment	Be able to formulate an effective strategy for personal adaptation to new conditions	Engage with a wide range of individuals (colleagues, management, experts in other fields) when new situations arise with elements of unpredictability	Be responsible for decision making
Ability to choose communication strategy, ability to work in a team.	Know the tactics and strategies of communication, the laws and methods of communicative behavior.	Be able to choose ways and strategies of communication to ensure effective teamwork.	Use communication strategies and interpersonal skills.	Be responsible for the choice and tactics of the communication method.
Ability to evaluate and ensure the quality of work performed.	Know the methods of evaluating performance indicators.	Be able to ensure the quality of professional work.	Make connections to ensure quality work.	Be responsible for quality work.
Ability to conduct research at the appropriate level.	Know the components of the health care system, planning and evaluating research.	Search for scientific sources of information; to choose the methods of scientific research; use methods of mathematical analysis and modeling, theoretical and experimental	Use information from scientific sources	Be responsible for the development and implementation of planned projects

		research in pharmacy		
<b>Special (professional) competencies</b>				
Ability to analyze the correspondence of the structure of bioorganic substances to biochemical functions performed in a living organism	Ability to analyze the correspondence of the structure of bioorganic substances to biochemical functions performed in a living organism	To be able to use the acquired knowledge to analyze the correspondence of the structure of bioorganic substances to the physiological functions of a living organism.	Form conclusions and professionally apply laws and regulations.	Be responsible for the quality and timely use of regulatory documents in professional activities.
Ability to explain the biochemical and molecular basis of physiological functions of cells, rgans and systems of human body	Know the basics biochemical and molecular basis of physiological functions of cells, organs and systems human body.	Be able to apply the acquired knowledge in the study of the biochemical and molecular basis of the functions of cells, organs and systems of the human body.	Development and registration of technological documentation.	Be responsible for quality design and design.
Ability to interpret the results of laboratory tests to explain the biochemical mechanisms of pathological processes in the human body and the principles of their correction with drugs.	Know the principles biochemical mechanisms of pathological processes in the human body and principles of their correction.	Be able to interpret occurrence of pathological processes in the human body and principles of their correction.	Organize pharmacy production activities.	Be responsible for the extemporaneous manufacture of medicines.

#### **Learning outcomes:**

**As a result of studying the discipline, the student must know:**

- place of clinical biochemistry in the system of medical and biological disciplines;
- principles of organization of laboratories performing biochemical analyzes;
- methods of diagnostic and therapeutic procedures appropriate for specific disease states;
- Methods of screening and dispensary research;
- principles of unification of clinical biochemical methods;
- modern ideas about the notion of norm in clinical biochemistry;

- basics of biosafety and bioethics;
- methods of diagnostics of diabetes mellitus, disorders of metabolism of monosaccharides, glycogenosis, mucopolysaccharidosis;
- mechanisms of metabolic syndrome development;
- biochemical composition of the heart muscle;
- principles of fermentation diagnostics of cardiovascular diseases;
- clinical and biochemical features in diseases of the bronchi-pulmonary system;
- structure and physiological role of surfactant;
- biochemical parameters of blood serum for pneumonia;
- principles of syndromic diagnosis of liver diseases;
- the concept of "clearance" based on determination of the concentration of urea and creatinine in serum and urine;
- the causes, symptoms, principles of diagnosis and therapeutic management of the most common internal diseases and their complications in adults: 1) cardiovascular diseases, including ischemic heart disease, heart defects, endocarditis, myocardial infarction, pericardial infarction, heart failure (acute and chronic), diseases of arteries and venous vessels, arterial hypertension - primary and secondary, pulmonary hypertension, 2) respiratory system diseases, including respiratory tract diseases, chronic obstructive pulmonary disease, bronchial asthma, bronchial dilatation, cystic fibrosis, respiratory infections, interstitial diseases of the lungs, pleura, mediastinum, obstructive and central sleep apnea, respiratory failure (acute and chronic), respiratory tumors, 3) diseases of the digestive system, including diseases of the mouth, esophagus, stomach and duodenum, intestines, pancreas, liver, bile ducts and gallbladder, 4) diseases of the internal secretion system, including diseases of the hypothalamus and pituitary gland, thyroidism, parathyroidism, adrenal cortex and medulla, ovaries and testicles, and neuroendocrine tumors, polyglandular syndromes, various types of diabetes and metabolic syndrome – hypoglycaemia, obesity, dyslipidemia, 5) diseases of the kidneys and the urinary tract, including acute and chronic renal failure, glomerulonephrine and interstitial kidney diseases, kidney cysts, kidney stones, urinary tract infections, urinary tract neoplasms, in particular of bladder and kidney neoplasms, 6) hematopoietic diseases, including bone marrow aplasia, anemia, granulocytopenia and agranulocytosis, thrombocytopenia, acute leukemia, myeloproliferative and myelodysplastic-myeloproliferative tumours, myelodysplastic syndromes, mature B and T lymphocytes tumors, bleeding diatheses, thrombophilia, life-threatening conditions in hematology, blood disorders in other organ diseases, 7) rheumatic diseases, including systemic connective tissue diseases, systemic vasculitis, joint inflammations involving spinal cord, metabolic bone diseases, osteoporosis and osteoarthritis in particular, gout, 8) allergic diseases, including anaphylaxis and anaphylactic shock and angioedema, 9) water-electrolyte and acid-base disorders: dehydration conditions, overhydration conditions, electrolyte, acidic and alkaline disorder;
- the types of biological materials to be used for laboratory diagnosis and the rules for the collection of test material;
- theoretical and practical basics of laboratory diagnostics;
- possibilities and limitations of laboratory tests in emergency situations;
- a complex of metabolic disorders inherent in urolithiasis;
- macromolecular structure of connective tissue of different localization;



- the main components of the intercellular matrix of bone and cartilage tissues - collagen, glycoproteins, proteoglycans;
- basic methods of fetal diagnostics and therapy;
- **the causes, symptoms, principles of diagnosis and therapeutic management of the most common diseases of children:** (1) rickets, tetanus, convulsions, (2) heart defects, myocarditis, endocarditis, pericarditis, cardiomyopathy, arrhythmia, heart failure, hypertension, syncope, (3) acute and chronic diseases of the upper and lower airways, congenital defects of the respiratory system, tuberculosis, cystic fibrosis, asthma, allergic rhinitis, urticaria, anaphylactic shock, angioedema, (4) anemia, hemorrhagic diatheses, conditions of bone marrow failure, pediatric neoplastic diseases, including solid tumors typical of childhood, (5) acute and chronic abdominal pain, vomiting, diarrhea, constipation, gastrointestinal bleeding, peptic ulcer disease, non-specific intestinal diseases, pancreatic diseases, cholestasis and liver diseases, and other acquired diseases and congenital defects of the digestive tract, (6) urinary tract infections, congenital anomalies of the urinary system, nephrotic syndrome, renal stones, acute and chronic renal failure, acute and chronic nephritis, systemic kidney diseases, urinary tract disorders, vesicoureteral reflux disease, (7) growing disorders, thyroid and parathyroid diseases, adrenal diseases, diabetes, obesity, disorders of puberty and gonadal functions, (8) cerebral palsy, encephalomyelitis, meningitis, epilepsy, (9) the most common infectious diseases of childhood, (10) genetic syndromes, (11) diseases of connective tissue, rheumatic fever, juvenile arthritis, systemic lupus, dermatomyositis;
- causes, symptoms, principles of diagnosis and therapeutic management in the most common diseases of the nervous system, including: 1) headaches: migraines, tension headaches and headache syndromes and neuralgia of the nerve V, 2) cerebral vascular diseases, in particular stroke, 3) epilepsy, 4) infections of the nervous system, in particular meningitis, borreliosis, herpetic encephalitis, neurotransmission diseases, 5) dementia, in particular: Alzheimer's disease, frontal dementia, vascular dementia and other dementia syndromes, 6) basal ganglia diseases, Parkinson's disease in particular, 7) demyelinating diseases, multiple sclerosis in particular, 8) diseases of the neuromuscular system, lateral atrophic sclerosis and sciatic neuralgia in particular, 9) craniocerebral injuries, cerebral palsy in particular;
- basics of early detection of neoplastic diseases and principles of screening in oncology;
- synovial fluid composition in norm and pathology;
- **changes in calcium-phosphorus metabolism in bone tissue pathology and its contributing factors;**
- **causes, symptoms, principles of diagnosis, therapeutic and prophylactic management in the most common bacterial, viral, parasitic and fungal diseases, including pneumococcal infections, viral hepatitis, acquired immunodeficiency syndrome (AIDS), sepsis and hospital infections;**
- **causes, symptoms, principles of diagnosis and therapeutic management in the most common diseases and specific problems in the practice of a family physician;**
- principles of diagnostics of infectious diseases and can interpret the results.

**be able:**

- explain the principles of the methods of obtaining biological material for biochemical research;
- to explain features of structure and function of blood proteins in norm and pathology;
- analyze changes in the system of components of residual nitrogen in the blood and urine in pathologies of individual organs;

- to explain the chemical nature of enzymes, their tissue specificity, diagnostic significance of isoenzymes, mechanisms of origin of primary and secondary fermentations;
- to analyze the mechanisms of regulation of carbohydrate metabolism and their disorders;
- explain the mechanisms of dyslipidemia and evaluate the diagnostic criteria of atherosclerosis as a chronic inflammatory response;
- perform differential diagnosis of the most common diseases of adults and children;
- interpret the results of laboratory tests and identify the causes of abnormalities;
- collect and retain test material for use in laboratory diagnostics;
- plan diagnostic, therapeutic and prophylactic procedures;
- to analyze the state of water-mineral exchange and its disturbance;
- explain the manifestations of disturbances of water and micro elemental composition of the organism;
- plan the diagnostic procedure and interpret its results;
- to establish clinical and biochemical criteria for hepatitis, hepatodystrophy, liver cirrhosis, pancreatitis, disorders of enteral metabolism;
- diagnose disorders of bilirubin metabolism, jaundice variants;
- explain the mechanisms of metabolic disorders in ischemic heart disease, myocardial infarction, myocarditis, myocardial dystrophy;
- to analyze the structure and functions of the kidneys and urinary tract;
- explain the mechanisms of formation of primary and secondary urine;
- to determine the composition of urine in the norm and pathology;
- to determine the diagnostic value of residual nitrogen system tests in kidney diseases;
- determine the syndromic characteristics of diseases of the urinary system;
- to analyze violations of mechanisms of regulation of urination;
- to explain changes in biochemical parameters in diseases of bones and joints (osteochondrosis, osteoarthritis, arthritis, aseptic necrosis, osteodystrophy, osteoporosis, tumors of bone and cartilage).

**is ready to:**

- perceive and recognize own limitations and self-assessing educational deficits and needs;
- use objective sources of information;
- respect medical confidentiality and patients' rights;
- implement the principles of professional camaraderie and cooperation in a team of specialists, including representatives of other medical professions, also in a multicultural and multinational environment;

**Information volume of the discipline**

90 hours of 3.0 ECTS credits are allotted for the course.

Content Module 1. Biochemical studies on major metabolic disorders.

Content module 2. Biochemical studies in diseases of the basic systems of the body.

## THE STRUCTURE OF THE STUDY DISCIPLINES

Names of modules, submodules and topics	Number of hours				
	Total	Lecturers	Sem	Lab.	i.w.
<b><i>Content Module 1. Biochemical studies on major metabolic disorders.</i></b>					
Topic 1. Introduction to clinical biochemistry. Principles of clinical and biochemical research organization. Constellations.	9	1	2	-	6
Topic 2. Clinical and biochemical studies on impaired protein metabolism. Serum proteins in normal and pathology; system of residual nitrogen. Pathologies of protein metabolism.	9	1	-	2	6
Topic 3. Enzymes and their role in diagnosis. Isoenzymes in diagnosis of diseases of internal organs	9	1	2	-	6
Topic 4. Clinical and biochemical studies on disorders of carbohydrate metabolism. Pathologies of carbohydrate metabolism.	9	1	-	2	6
Topic 5. Clinico-biochemical studies on lipid metabolism disorders. Pathologies of lipid metabolism. MR Control 1.	9	1	-	2	6
Together for Content Module 1	45	5	4	6	30
<b><i>Content module 2. Biochemical studies in diseases of the basic systems of the body.</i></b>					
Topic 6. Clinical and biochemical studies on diseases, bronchopulmonary and cardiovascular system.	9	1	2	-	6
Topic 7. Clinical and biochemical studies in diseases of the gastrointestinal tract and pancreas. Biochemical research in liver diseases.	10	2	-	2	6
Topic 8. Clinical and biochemical studies in diseases of the kidneys and urinary tract. Pathology of the excretory system.	9	1	-	2	6
Topic 9. Clinical and biochemical studies in connective tissue diseases. Disorders of the organic and mineral phase of bone tissue. MR control 2.	9	1	2	-	6
Topic 10. Final module control.	8	-	2	-	6
Together for content module 2	45	5	6	4	30
<b>TOTAL HOURS</b>	<b>90</b>	<b>10</b>	<b>10</b>	<b>10</b>	<b>60</b>

### Topics of lectures

No.	The name of the topic	Hours
1	Introduction to clinical biochemistry. Principles of clinical and biochemical research organization. Constellations.	1
2	Clinical and biochemical studies on protein metabolism disorders. Serum proteins	1

	in normal and pathology; system of residual nitrogen. Pathologies of protein metabolism.	
<b>3</b>	<b>Enzymes and their role in diagnosis. Isoenzymes in diagnosis of diseases of internal organs.</b>	<b>1</b>
<b>4</b>	<b>Clinical and biochemical studies on disorders of carbohydrate metabolism. Pathologies of carbohydrate metabolism.</b>	<b>1</b>
<b>5</b>	<b>Clinical and biochemical studies of disorders. Pathologies of lipid metabolism.</b>	<b>1</b>
<b>6</b>	<b>Clinical and biochemical studies on diseases, bronchopulmonary and cardiovascular system.</b>	<b>1</b>
<b>7</b>	<b>Clinical and biochemical studies in diseases of the gastrointestinal tract and pancreas. Biochemical research in liver diseases.</b>	<b>1</b>
<b>8</b>	<b>Clinical and biochemical studies in diseases of the kidneys and urinary tract. Pathology of the excretory system.</b>	<b>1</b>
<b>9</b>	<b>Clinical and biochemical studies in connective tissue diseases. Disorders of the organic and mineral phase of bone tissue.</b>	<b>1</b>
	<b>TOTAL</b>	<b>10</b>

### Topics of seminars

<b>No.</b>	<b>The name of the topic</b>	<b>Hours</b>
<b>1</b>	<b>Introduction to clinical biochemistry. Principles of clinical and biochemical research organization. Constellations.</b>	<b>2</b>
<b>2</b>	<b>Clinical and biochemical studies on protein metabolism disorders. Serum proteins in normal and pathology; system of residual nitrogen. Pathologies of protein metabolism.</b>	<b>-</b>
<b>3</b>	<b>Enzymes and their role in diagnosis. Isoenzymes in diagnosis of diseases of internal organs.</b>	<b>2</b>
<b>4</b>	<b>Clinical and biochemical studies on disorders of carbohydrate metabolism. Pathologies of carbohydrate metabolism.</b>	<b>-</b>
<b>5</b>	<b>Clinical and biochemical studies of disorders. Pathologies of lipid metabolism.</b>	<b>-</b>
<b>6</b>	<b>Clinical and biochemical studies on diseases, bronchopulmonary and cardiovascular system.</b>	<b>2</b>
<b>7</b>	<b>Clinical and biochemical studies in diseases of the gastrointestinal tract and pancreas. Biochemical research in liver diseases.</b>	<b>-</b>
<b>8</b>	<b>Clinical and biochemical studies in diseases of the kidneys and urinary tract. Pathology of the excretory system.</b>	<b>-</b>
<b>9</b>	<b>Clinical and biochemical studies in connective tissue diseases. Disorders of the organic and mineral phase of bone tissue.</b>	<b>2</b>
	<b>Final module control</b>	<b>2</b>
	<b>TOTAL</b>	<b>10</b>

### Topics of laboratories

No.	The name of the topic	Hours
1	Introduction to clinical biochemistry. Principles of clinical and biochemical research organization. Constellations.	-
2	Clinical and biochemical studies on protein metabolism disorders. Serum proteins in normal and pathology; system of residual nitrogen. Pathologies of protein metabolism.	2
3	Enzymes and their role in diagnosis. Isoenzymes in diagnosis of diseases of internal organs.	-
4	Clinical and biochemical studies on disorders of carbohydrate metabolism. Pathologies of carbohydrate metabolism.	2
5	Clinical and biochemical studies of disorders. Pathologies of lipid metabolism.	2
6	Clinical and biochemical studies on diseases, bronchopulmonary and cardiovascular system.	-
7	Clinical and biochemical studies in diseases of the gastrointestinal tract and pancreas. Biochemical research in liver diseases.	2
8	Clinical and biochemical studies in diseases of the kidneys and urinary tract. Pathology of the excretory system.	2
9	Clinical and biochemical studies in connective tissue diseases. Disorders of the organic and mineral phase of bone tissue.	-
10	Final module control	
TOTAL		10

#### Topics of individual work

No.	The name of the topic	Hours
1	Introduction to clinical biochemistry. Principles of clinical and biochemical research organization. Constellations.	6
2	Clinical and biochemical studies on protein metabolism disorders. Serum proteins in normal and pathology; system of residual nitrogen. Pathologies of protein metabolism.	6
3	Enzymes and their role in diagnosis. Isoenzymes in diagnosis of diseases of internal organs.	6
4	Clinical and biochemical studies on disorders of carbohydrate metabolism. Pathologies of carbohydrate metabolism.	6
5	Clinical and biochemical studies of disorders. Pathologies of lipid metabolism.	6
6	Clinical and biochemical studies on diseases, bronchopulmonary and cardiovascular system.	6
7	Clinical and biochemical studies in diseases of the gastrointestinal tract and pancreas. Biochemical research in liver diseases.	6
8	Clinical and biochemical studies in diseases of the kidneys and urinary tract. Pathology of the excretory system.	6
9	Clinical and biochemical studies in connective tissue diseases. Disorders of the organic and mineral phase of bone tissue.	6
10	Final module control	6

### Individual tasks

The curriculum is not provided.

Tasks for independent work Independently, using the recommended information sources, each higher education student completes individual tasks. Appropriate control is organized individually by the teacher.

## Learning methods

The following are used in the course of clinical biochemistry

- teaching methods: verbal (lecture, discussion, questionnaire, discussion), eye (illustrations, diagrams, tables, work with textbook and other sources of information), practical (testing, problem solving).
- teaching methods: a combination of explanatory, illustrative and problematic search methods. learning technologies: problem-based learning, programmed learning technology, computer technology, developmental learning.

## Control methods

Ongoing control is carried out at each practical session according to the specific objectives of the topic. It contains: polls, interviews, answers to questions, computer testing, presentation, presentation of abstracts.

Practical control is aimed at testing the skills acquired by higher education students. Its main forms are: solving experimental and situational tasks, conducting experiments and observations, and interpreting and evaluating their results.

The final control is carried out at the end of each module.

The maximum number of points awarded to higher education students in mastering the module (credit credit) is 100, including 60 points for the current educational activity, and 40 points for the results of the module final control

Assessment of current educational activities is carried out in classes using standard methods of control; in mastering each topic of the module for the current educational activities of the higher education student points are awarded according to the principle (arithmetic mean score for the content module):

The maximum number of points that a higher education student can earn when studying a module is calculated by adding up the points earned by him / her for each class and the content module, as well as by adding a certain amount of points for independent work or additional activities. The amount is 60 points.

The minimum number of points that a higher education student can earn when studying a module is calculated by adding up the points earned by him / her for each class and the content module. The sum is 35 points.

**Modular final control is carried out upon completion of the study module. Higher education applicants who have completed all types of work required by the work curriculum and have accumulated the required number of points not less than the minimum are admitted to the final control.**

The form of final control should be standardized (written test or test control) and should include theoretical and practical training.

Approved:



**В.о.Ректора /Acting Rector** **Iryna DOROSHENKO**