



MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE RUSSIAN FEDERATION  
Federal State Autonomous Educational Institution of Higher Education

**Far Eastern Federal University**  
(FEFU)

**INSTITUTE OF LIFE SCIENCES AND BIOMEDICINE (SCHOOL)**

AGREED

Head of Educational  
Program

V.V. Kumeiko

(Signed) (Surname)

CLAIM

Director of the Production Company  
Structural subdivision

V.V. Kumeiko

(Signed) (Surname)

April 12, 2023

### WORK PROGRAM OF THE DISCIPLINE

*Clinical Diagnostic Methods*

*Area of study 06.03.01 Biology*

*Form of training: full-time*

*The work program is drawn up in accordance with the requirements of the Federal State Educational Standard in the field of training 06.03.01 Biology, approved by the order of the Ministry of Education and Science of Russia dated 07.08.2020 No. 920*

The work program was discussed at the meeting of the Department of Medical Biology and Biotechnology, Minutes No. 3 dated April 12, 2023.

Director of the Department of Medical Biology and Biotechnology V.V. Kumeiko

Compiled by: Ph.D. Kumeiko V.V.

Vladivostok  
2022

Back of the title page of the RPD

1. *The work program was revised at the meeting of the Department/Department/Division (implementing the discipline) and approved at the meeting of the Department/Department/Division (graduating structural unit), minutes of "*  
\_\_\_\_\_ 202 No.
2. *The work program was revised at the meeting of the Department/Department/Division (implementing the discipline) and approved at the meeting of the Department/Department/Division (graduating structural unit), minutes of "*  
\_\_\_\_\_ 202 No.
3. *The work program was revised at the meeting of the Department/Department/Division (implementing the discipline) and approved at the meeting of the Department/Department/Division (graduating structural unit), minutes of "*  
\_\_\_\_\_ 202 No.
4. *The work program was revised at the meeting of the Department/Department/Division (implementing the discipline) and approved at the meeting of the Department/Department/Division (graduating structural unit), minutes of "*  
\_\_\_\_\_ 202 No.
5. *The work program was revised at the meeting of the Department/Department/Division (implementing the discipline) and approved at the meeting of the Department/Department/Division (graduating structural unit), minutes of "*  
\_\_\_\_\_ 202 No.

## **Abstract of the discipline**

*Clinical Diagnostic Methods*

The total labor intensity of the discipline is 5 credits / 180 academic hours. It is a discipline of the compulsory part of the EP, studied in the 4th year and ends *with an exam*. The curriculum provides for 18 hours of lectures, 18 *hours* of practical work, 36 hours of laboratory work, and *108 hours* of independent work for the student.

**Language: Russian.**

**Objective:** to form students' knowledge, skills and abilities necessary for the successful acquisition of general cultural and professional competencies in the field of clinical laboratory diagnostics that ensure the graduate's ability to independent professional activity.

### **Tasks:**

1. Formation of basic knowledge in the field of modern methods of laboratory diagnostics and the basics of laboratory medicine;
2. Mastering the basic methods of diagnosing the state of health of the population in various forms of pathology, taking into account sensitivity and specificity, permissible variation of laboratory methods;
3. Formation of skills of working with regulatory and technical documentation, analysis of literature on the problems of clinical laboratory diagnostics;
4. Mastering the methods of organizing and conducting quality control of laboratory tests.

For successful study of the discipline, students should have the following preliminary competencies:

- Analyzes biochemical and molecular-biological mechanisms of the development of pathological processes in the cells and tissues of the human body and applies the principles of cellular organization of biological objects;

- understands and investigates the physical processes that underlie the functioning of the body in normal and pathological conditions, understands the influence of physical factors on the functioning of biological systems, is able to study the physical structure of biologically important molecules in order to identify the relationship between the structure of substances and their biological activity;

- and uses the methods of molecular-genetic, cellular and physiological studies to study physiological processes in the body.

The competencies were obtained as a result of studying the disciplines of *immunology, pathology with the basics of nosology, and histologia*.

Students' Competencies, Indicators of Their Achievement and Learning Outcomes in the Discipline

Code and name of the competency (result of mastering)	Code and name of the competency indicator
PC-6 Able to use modern knowledge and methods of genetics, molecular and cellular biology to solve professional problems	PP-6.1 Uses knowledge and methods of genetics, molecular and cellular biology to study living systems
	PC-6.2 Applies methods of genetics, molecular and cellular biology to identify the mechanisms of pathological processes
	PC-6.3 Able to develop clinical diagnostic systems using knowledge and methods of genetics, molecular and cellular biology
	PC-6.4 Able to perform studies in the field of clinical laboratory diagnostics, molecular-genetic and cytological studies in order to identify the causes of the disease and make a diagnosis

Code and name of the competency indicator	Name of the assessment indicator (the result of learning in the discipline)
PP-6.1 Uses knowledge and methods of genetics, molecular and cellular biology to study living systems	Knows Modern methods of genetics and molecular and cellular biology for the study of living systems. Can Conduct research in genetics and molecular and cellular biology to study living systems. Owns skills in the use of research methods in the field of genetics and molecular and cellular biology for the study of living systems.
PC-6.2 Applies methods of genetics, molecular and cellular biology to identify the mechanisms of pathological processes	Knows Methods of diagnosing pathological conditions. Can to use fundamental knowledge and biophysical methods to diagnose pathological conditions. Owns skills in the application of fundamental knowledge and biophysical methods for the diagnosis of pathological conditions.
PC-6.3 Able to develop clinical diagnostic systems using knowledge and methods of genetics, molecular and cellular biology	Knows Methods of diagnosing pathological conditions. Can to use fundamental knowledge and biophysical methods to diagnose pathological conditions. Owns skills in the application of fundamental knowledge and biophysical methods for the diagnosis of pathological conditions.
PC-6.4 Able to perform studies in the field of clinical laboratory diagnostics, molecular-genetic and cytological studies in order to identify the causes of the disease and make a diagnosis	Knows research methods in the field of clinical laboratory diagnostics, molecular-genetic and cytological research methods. Can perform research in the field of clinical laboratory diagnostics, molecular-genetic and cytological studies. Owns ability to perform studies in the field of clinical laboratory diagnostics, molecular-genetic and cytological studies in order to identify the causes of the disease and make a diagnosis.

To form the above competencies within the discipline "Methods of Clinical Diagnosis", the following educational technologies and methods of active/interactive learning are used: a business game, work in small groups, a round table.

## I. Goals and objectives of mastering the discipline

**Objective:** to form students' knowledge, skills and abilities necessary for the successful acquisition of general cultural and professional competencies in the field of clinical laboratory diagnostics that ensure the graduate's ability to independent professional activity.

### Tasks:

1. Formation of basic knowledge in the field of modern methods of laboratory diagnostics and the basics of laboratory medicine;
2. Mastering the basic methods of diagnosing the state of health of the population in various forms of pathology, taking into account sensitivity and specificity, permissible variation of laboratory methods;
3. Formation of skills of working with regulatory and technical documentation, analysis of literature on the problems of clinical laboratory diagnostics;
4. Mastering the methods of organizing and conducting quality control of laboratory tests.

### Students' Competencies, Indicators of Their Achievement and Learning Outcomes in the Discipline

Code and name of the competency (result of mastering)	Code and name of the competency indicator
PC-6 Able to use modern knowledge and methods of genetics, molecular and cellular biology to solve professional problems	PP-6.1 Uses knowledge and methods of genetics, molecular and cellular biology to study living systems
	PC-6.2 Applies methods of genetics, molecular and cellular biology to identify the mechanisms of pathological processes
	PC-6.3 Able to develop clinical diagnostic systems using knowledge and methods of genetics, molecular and cellular biology
	PC-6.4 Able to perform studies in the field of clinical laboratory diagnostics, molecular-genetic and cytological studies in order to identify the causes of the disease and make a diagnosis

Code and name of the competency indicator	Name of the assessment indicator (the result of learning in the discipline)
PP-6.1 Uses knowledge and methods of genetics, molecular and cellular biology to study living systems	Knows Modern methods of genetics and molecular and cellular biology for the study of living systems. Can Conduct research in genetics and molecular and cellular biology to study living systems. Owns skills in the use of research methods in the field of genetics and molecular and cellular biology for the study of living systems.



1	Module 1. Organization of laboratory services.	7	2	4	2	-	54	54	Exam Questions
2	Module 2. Biochemical diagnostics of liver diseases.		2	4	2				Exam Questions
3	Module 3. Biochemical diagnostics of diseases of the pancreas and cardiovascular system.		2	4	2				Exam Questions
4	Module 4. Biochemical diagnostics of kidney diseases.		2	4	2				Exam Questions
5	Module 5. Biochemical research methods for blood diseases.		2	4	2				Exam Questions
6	Module 6. General clinical and cytological research methods.		2	4	2				Exam Questions
7	Module 7 Methods of Immune System Research.		2	4	2				Exam Questions
8	Module 8 Features of the immune status in various immunopathological conditions.		2	4	2				Exam Questions
9	Module 9 Laboratory Diagnosis of Infectious Diseases. Emergencies.		2	4	2				Exam Questions
Total:		7	18	36	18	-	54	54	exam

#### IV. THE CONTENT OF THE THEORETICAL PART OF THE COURSE

##### Lecture

##### Module 1. Organization of laboratory services.

Clinical Laboratory Diagnostics, Its Sections, History and Development Prospects. Types and structure of laboratories. Staffing requirements. Technological process of laboratory research. Pre-analytical stage of analysis: rules for obtaining biomaterial for biochemical, immunological, genetic, bacterioscopic, bacteriological studies. Requirements for patient preparation, collection, storage, transportation of biological material. Evaluation of the analytical reliability of the test: correctness, reproducibility, specificity and sensitivity of the methods. Factors influencing the result of the analysis. Preparation of preparations from various body fluids. Methods of fixation and staining of preparations. Transportation and storage of biological material.

The relevance of automation of laboratory tests. Opportunities and Benefits of Automation in Clinical Chemistry Using Computerized Analyzers. Classification of

biochemical autoanalyzers. Differences between open and closed systems. Dry Chemistry Analyzers.

### **Module 2. Biochemical diagnostics of liver diseases.**

Liver. Laboratory tests for diagnosing liver diseases. Clinical and biochemical syndromes. Enzyme diagnostics of liver diseases. Significance of alanine and aspartate aminotransferase, lactate dehydrogenase,  $\gamma$ -glutamyl transpeptidase, alkaline phosphatase, glutamate dehydrogenase, sorbitol dehydrogenase. Hyper- and hypoenzymeemia. Determination of enzyme activity.

Types of jaundice: prehepatic, hepatic, subhepatic. Hyperbilirubinemia and bilirubinuria. Formation of bilirubin and its fractions in the blood, liver, intestines, kidneys. Free (indirect) and conjugated (direct) bilirubin, urobilinogen and stercobilinogen, bile pigments. Bilirubin toxicity. Neonatal jaundice.

Reference values, differential diagnosis of liver diseases. Bilirubin fractions in blood, urine, feces.

Albumins, hyper- and hypoalbuminemia.  $\alpha$ 1-globulins,  $\alpha$ 2-globulins,  $\beta$ globulins,  $\gamma$ -globulins. Proteins of the acute phase of inflammation. Determination of total protein and albumin content in blood serum. Determination of total protein and albumin content in blood serum. Electrophoresis of proteins on cellulose acetate film. Types of Proteinograms

### **Module 3. Biochemical diagnostics of diseases of the pancreas and cardiovascular system.**

Biochemical diagnostics of pancreatic diseases. Pancreas, structure, functions. Assessment of pancreatic function. Enzyme activity in duodenal juice. Assessment of the excretory function of the pancreas. Enzyme activity in duodenal juice. Pancreatitis, diagnostic value of determining the activity of  $\alpha$ -amylase, lipase, trypsin,  $\alpha$ 1-proteinase inhibitor. Diagnostic criteria for type I and type II diabetes mellitus. Hyperglycemia and glycosuria. Diabetes mellitus, definition, classification and clinical signs. Diagnostic criteria for type I and type II diabetes mellitus. Hyperglycemia and glycosuria. Impaired fasting glycemia, impaired glucose tolerance, postprandial hyperglycemia. Effective control of hyperglycemia: determination of glycosylated hemoglobin, fructosamine. Lipid spectrum indicators. Assessment of complications of diabetes mellitus.

Laboratory diagnostics of diseases of the cardiovascular system. Diagnostic value of determining the content of cholesterol and its fractions in the composition of blood lipoproteins. Lipid metabolism disorders. Determination of lipid metabolism indicators: cholesterol, triacylglycerols, lipoproteins, apo-proteins. The main indicators of atherosclerosis are total cholesterol,  $\alpha$ -cholesterol (HDL), atherogenicity index. Recommended and borderline values of total cholesterol, moderate to severe hypercholesterolemia. Myocardial infarction. Main metabolic disorders in acute myocardial infarction. Cardio-specific proteins. Enzyme diagnostics of myocardial infarction.

Recommended and borderline values of total cholesterol, moderate to severe hypercholesterolemia. Differential diagnosis of heart disease.

### **Module 4. Biochemical diagnostics of kidney diseases.**

Laboratory diagnostics of kidney diseases. Major kidney diseases: glomerulonephritis, pyelonephritis, renal failure, nephrotic syndrome, nephrolithiasis.



Filtration, reabsorption, secretion. Diuresis and its disorders: polyuria, oligouria, anuria, nocturia. Clearance, transport maximum, renal threshold, functional indicators of renal function. Physiological and pathological components of urine, methods of their determination. Determination of protein content in urine by pyrogallol method.

Clinical and diagnostic value of urea, creatinine and uric acid. Microalbuminuria and proteinuria. Pathological components of urine: glycosuria, proteinuria.

Positive and negative water balance of the body. Swelling. Mechanisms of edema development in cardiovascular system insufficiency and kidney diseases.

Diagnostics of water-electrolyte and mineral metabolism disorders. Mechanisms of edema development in cardiovascular system insufficiency and kidney diseases.

Acid-base balance of the body and its disorders. Clinical Diagnostic Value of Acid-Base Blood Equilibrium Indicators.

### **Module 5. Biochemical research methods for blood diseases.**

Structure and functions of the blood system, scheme and basics of regulation of hematopoiesis, kinetics, morphological, cyto-, biochemical and functional features of blood cells. Manual and automated methods of hematological examinations. Counting the number of red blood cells, determining the hematocrit, the sedimentation rate of red blood cells.

Methods for determining hemoglobin. Pathological forms of erythrocytes. Leukocyte count, leukocyte formula. Pathological forms of leukocytes. Platelet count. Methods of studying the blood system: morphological, cytochemical, molecular-genetic. Their specificity, sensitivity, diagnostic significance. Methods Used in Hematology Analyzers and Flow Cytometers

Methods for the study of platelet-vascular hemostasis, types of thromboelastograms and aggregationograms. Monitoring of disaggregant therapy.

Methods for the study of coagulation hemostasis, Indicators of the external, internal pathway and stages of coagulation. Methods for determining coagulation factors and differential diagnosis of hemophilias.

Markers of thrombosis, DIC syndrome, antiphospholipid syndrome. Hemostasis in mesenchymal dysplasia.

Methods of investigation of the anticoagulant link of hemostasis and fibrinolysis. Criterion for fibrinolysis activation.

### **Module 6. General clinical and cytological research methods.**

General clinical studies of biological fluids in diseases of the bronchopulmonary, urinary, digestive systems, central nervous system.

Microscopic examination of duodenal contents in duodenal and biliary system lesions. Investigation of the physical and chemical properties of intestinal contents. Microscopic examination of the intestine discharge. Features of coprograms in lesions of the pancreas, small and large intestine, disorders of the evacuation function of the intestines and congenital pathology. Cytological Diagnosis of Thyroid Diseases: Clinical Diagnostic Value of Cytological Parameters.

Cytological diagnostics of diseases in gynecology: morphological classifications of diseases of the cervix and uterus, cytogram, vaginal microflora, benign changes in the epithelium, precancerous diseases and malignant tumors of the cervix and uterus.

### **Module 7 Methods of Immune System Research.**

Innate antigen-non-specific factors of the body's immune reactivity. Humoral antigen-non-specific factors of immune defense, complement system and its immunobiological activity. Immunoglobulins (antibodies). Tissue compatibility antigens and their genetic control. Hormones and cytokines of the immune system. Neurohormonal regulation of the immune system. Immunological tolerance.

Serological research methods. AG-AT reactions. Precipitation reaction.

Agglutination reaction and its various variants. Complement binding reactions.

Erythrocyte system antigen typing (ABO, Rh). Typing of leukocyte transplant antigens (HLA). Platelet system antigen typing. Typing of plasma protein antigens. Clinical and diagnostic value of the study of blood system antigens.

Methods based on the use of labeled reaction components. Enzyme-linked immunosorbent and immunofluorescence assay

### **Module 8 Features of the immune status in various immunopathological conditions.**

Laboratory assessment of humoral and cellular immunity, mediators of inflammation and apoptosis. Immune status in immunodeficiency conditions, autoimmune and oncological diseases. Specific allergy diagnostics. Evaluation of the Efficacy of Immunocorrective Therapy

### **Module 9 Laboratory Diagnosis of Infectious Diseases. Emergencies.**

Methods of laboratory diagnostics of urogenital infections: cytological, cultural, immunological. Methods of Molecular Biology. Enzyme-linked immunosorbent assay and immunofluorescence reaction.

Laboratory diagnostics of acute viral and chronic hepatitis. Clinical laboratory diagnostics of HIV infection. Prognosis of HIV infection progression and laboratory monitoring of treatment efficacy.

Specific tests: syphilis, borreliosis, gonorrhoea, tuberculosis, Helicobacter pylori infection, mycoplasma, ureaplasma, chlamydial infection.

Etiology and pathogenesis of syphilis. Technique of taking material from patients. Laboratory diagnostics of various forms of syphilis. Microscopy of a pallid spirochete in a dark field of view. Interpretation of syphilis laboratory results.

Etiology and pathogenesis of gonorrhoea. Technique of taking material from patients. Bacterioscopic, serological and molecular-genetic methods for the study of gonorrhoea.

Evaluation of laboratory test results.

Morphology of trichomonas. Pathogenicity factors of vaginal and urethral trichomonas. Taking material for laboratory tests. Laboratory diagnostics. Evaluation of research results.

Laboratory diagnostics of acute viral and chronic hepatitis. Clinical laboratory diagnostics of HIV infection. Prognosis of HIV infection progression and laboratory monitoring of treatment efficacy.

Diagnosis of fungal diseases: aspergillosis, candidiasis.

Diagnosis of parasitic infections: protozoal infections, helminthiases.

Organization of express examinations in intensive care units. Laboratory tests for shock states, shock organs, multiple organ failure syndrome.

## V. CONTENT OF THE PRACTICAL PART OF THE COURSE AND INDEPENDENT WORK

### Practical exercises

#### Topic 1. Organization of laboratory services

1. Clinical laboratory diagnostics, its sections, history and development prospects. Types and structure of laboratories. Staffing requirements.

2. Technological process of laboratory research. Pre-analytical stage of analysis: rules for obtaining biomaterial for biochemical, immunological, genetic, bacterioscopic, bacteriological studies. Vacuum blood collection system. Requirements for patient preparation, collection, storage, transportation of biological material.

3. Evaluation of the analytical reliability of the test: correctness, reproducibility, specificity and sensitivity of the methods. Factors influencing the result of the analysis.

4. Quality control of laboratory tests (internal and external) and the basics of statistical processing of results. Metrology, calibration and control materials. Sources of non- and intra-laboratory errors. Standardization of research in the laboratory.

5. Use of laboratory information systems in the organization of the diagnostic process and research quality management.

6. Characteristics of physical and chemical principles of methods and equipment of clinical diagnostic laboratories. Analytical spectroscopy in the ultraviolet and visible spectral regions. Photometers and spectrophotometers. Turbidimetry, and nephelometry, fluorescence. Electrophoresis. Modern types of carriers used for electrophoresis. Saturation substitution assay: radioisotope, enzyme immunoassay, immunochemical assay. ELISA capabilities in diagnosing infectious, hormonal, metabolic, autoimmune, allergic and other types of diseases. Molecular Biological Methods of Laboratory Research. PCR diagnostics.

7. Relevance of automation of laboratory tests. Opportunities and Benefits of Automation in Clinical Chemistry Using Computerized Analyzers. Classification of biochemical autoanalyzers. Differences between open and closed systems. Dry Chemistry Analyzers.

#### Topic 2. Biochemical Studies in Clinical Laboratory Diagnostics

1. Biochemical studies in liver diseases. Hepatocyte integrity disorder: cytolysis syndrome, hyperpermeability, hyperfermentemia. Excretory-biliary syndrome: ratio of enzyme activity and bilirubin fractions. Inflammatory syndrome: total serum protein and protein fractions, types of proteinograms. Enzyme diagnostics of liver diseases. Algorithm for differential diagnosis of jaundice. Clinical and diagnostic value of total bilirubin, direct and indirect bilirubin, urobilinogen and stercobilinogen in blood, urine, feces. Laboratory monitoring of neonatal jaundice.

2. Biochemical diagnostics of pancreatic diseases. Assessment of the excretory function of the pancreas. Enzyme activity in duodenal juice. Pancreatitis, diagnostic value of determining the activity of  $\alpha$ -amylase, lipase, trypsin,  $\alpha$ 1-proteinase inhibitor.

3. Diagnostic criteria for type I and type II diabetes mellitus. Hyperglycemia and glycosuria. Effective control of hyperglycemia: determination of glycosylated hemoglobin, fructosamine. Lipid spectrum indicators. Assessment of complications of diabetes mellitus.

4. Laboratory diagnostics of diseases of the cardiovascular system. Diagnostic value of determining the content of cholesterol and its fractions in the composition of blood lipoproteins. Apolipoproteins.

5. Myocardial infarction. Main metabolic disorders in acute myocardial infarction. Cardio-specific proteins. Enzyme diagnostics of myocardial infarction. A protein that binds fatty acids. Sodium peptide.

6. Laboratory diagnostics of kidney diseases. Physiological and pathological components of urine, methods of their determination. Clinical and diagnostic value of urea, creatinine, glomerular filtration rate, cystatin C, uric acid. Microalbuminuria and proteinuria. Biochemical diagnostics in acute exogenous and chronic poisoning: specific changes in blood parameters, markers of liver and kidney damage.

7. Diagnostics of iron metabolism disorders in blood loss, purulent and septic diseases, pregnancy, thalassemia, neonatal jaundice, malignant diseases. Ferritin.

8. Diagnostics of water-electrolyte and mineral metabolism disorders. Mechanisms of edema development in cardiovascular system insufficiency and kidney diseases. Hyper- and hypokalemia, clinical manifestations. Calcium, hyper- and hypocalcemia in children and adults. Hyper- and hypophosphatemia in children and adults. Methods for determining mineral metabolism indicators. Markers of bone metabolism and osteoporosis.

9. Acid-base balance of the body and its disorders. Clinical and diagnostic value of acid-base balance of blood. Forms of acid-base disorder. Laboratory diagnostics of critical conditions.

10. Laboratory diagnostics of endocrine system diseases.

### Topic 3. General clinical and cytological research methods

Preparation for laboratory tests. Preparation of preparations from blood, urine, sputum, feces, cerebrospinal fluids, effusions, etc. The role and place of general clinical studies in the algorithms for diagnosing various nosological forms. General clinical studies of biological fluids in diseases of the bronchopulmonary, urinary, digestive systems, central nervous system. Cytological diagnostics of thyroid gland diseases: clinical and diagnostic value of cytological parameters. Cytological diagnostics of diseases in gynecology: morphological classifications of diseases of the cervix and uterus, cytogram, vaginal microflora, benign changes in the epithelium, precancerous

diseases and malignant tumors of the cervix and uterus. Possibilities and limitations of cytological diagnosis of the mammary gland, processing of material for cytological examination. Cellular elements in benign and malignant breast lesions, tumor markers? in the diagnosis of breast cancer.

#### Topic 4. Hematological examinations.

Structure and functions of the blood system, scheme and basics of hematopoiesis regulation, kinetics, morphological, cyto-, biochemical and functional features of blood cells. Their specificity, sensitivity, diagnostic significance. Methods Used in Hematology Analyzers and Flow Cytometers Changes in hematological parameters in reactive and inflammatory conditions. Algorithm for diagnosing diseases associated with changes in the number and properties of erythrocytes, leukocytes and platelets. Clinical and diagnostic value of hemograms and myelograms in anemias, leukemias, hemorrhagic diatheses and oncological diseases of the blood system.

#### Topic 5. Blood clotting. Methods for assessing the hemostasis system

Methods for the study of platelet-vascular hemostasis, types of thromboelastograms and aggregationograms. Monitoring of disaggregant therapy. Methods for the study of coagulation hemostasis, Indicators of the external, internal pathway and stages of coagulation. Methods for determining coagulation factors and differential diagnosis of hemophilias. Markers of thrombosis, DIC syndrome, antiphospholipid syndrome. Hemostasis in mesenchymal dysplasia. Methods of investigation of the anticoagulant link of hemostasis and fibrinolysis. Criterion for fibrinolysis activation.

#### Topic 6. Features of the immune status in various immunopathological States

1. Laboratory assessment of humoral and cellular immunity, mediators of inflammation and apoptosis.
2. Immune status in immunodeficiency conditions, autoimmune and oncological diseases.
3. Specific allergy diagnostics.
4. Evaluation of the efficacy of immunocorrective therapy.

#### Topic 7. Algorithms for Laboratory Diagnostics of Infectious Diseases

1. Methods of laboratory diagnostics of urogenital infections: cytological, cultural, immunological. Methods of Molecular Biology. Enzyme-linked immunosorbent assay and immunofluorescence reaction.
2. Laboratory diagnostics of acute viral and chronic hepatitis.

3. Clinical and laboratory diagnostics of HIV infection. Prognosis of HIV infection progression and laboratory monitoring of treatment efficacy.
4. Specific tests: syphilis, borreliosis, gonorrhea, tuberculosis, Helicobacter pylori infection, mycoplasma, ureaplasma, chlamydial infection.
5. Diagnosis of fungal diseases: aspergillosis, candidiasis.
6. Diagnostics of parasitic infections: protozoal infections, helminthiases.

#### Topic 8. Molecular Genetic Diagnostics

1. Use of DNA diagnostics in hemochromatosis, hereditary thrombophilia, familial hypercholesterolemia, cystic fibrosis, hypertrophic cardiomyopathy.
2. Profiles of genetic risk markers for major cardiovascular, neurological diseases, thrombosis, osteoporosis.
3. Genetic markers of drug metabolism disorders, xenobiotic detoxification and cancer development. Tumor markers.

#### Topic 9. Laboratory diagnostics of emergency conditions

1. Organization of express examinations in intensive care units. Syndromic diagnosis. Laboratory tests for shock states, shock organs, multiple organ failure syndrome.
2. Diagnostics of acid-base metabolism, oxygen transport, water-electrolyte metabolism, patient's energy state. Markers of sepsis.

### **Labs**

#### **Module 1. Organization of laboratory services**

Obtaining and preparing biological material for research.

#### **Module 2. Biochemical diagnostics of liver diseases**

Biochemical research methods.

Laboratory diagnostics of liver diseases.

#### **Module 3. Biochemical diagnostics of diseases of the pancreas and cardiovascular system**

Laboratory diagnostics of pancreatic diseases. Determination of amylase, lipase, trypsin activity. Pancreatitis.

Laboratory diagnostics of diabetes mellitus. Methods for determining glucose content.

Laboratory diagnostics of lipid metabolism disorders. Atherosclerosis.

#### **Module 4. Biochemical Diagnosis of Kidney Diseases**

Laboratory assessment of the body's acid-base balance.

Alkalosis and acidosis: respiratory, metabolic, compensated, decompensated.

Methods for determining mineral metabolism indicators.

#### **Module 5. Biochemical research methods for blood diseases.**

Methods of hemostasis system research.

Methods for assessing the hemostasis system.

Methods of hematological research.

Quantitative methods for counting blood cells and bone marrow.

### **Module 6. General clinical and cytological research methods**

General clinical and cytological studies in diseases of the female and male reproductive organs.

Diseases of the central nervous system. Study of the physical and chemical properties of cerebrospinal fluid.

### **Module 7. Immune System Research Methods**

Methods for studying blood system antigens. Antigen typing.

Enzyme-linked immunosorbent methods in laboratory diagnostics. Diagnosis and monitoring of infectious diseases.

### **Module 8. Features of the immune status in various immunopathological**

Study of the immune status of the human body.

Molecular-genetic methods for diagnosing hereditary diseases.

### **Module 9. Laboratory diagnostics of infectious diseases. Emergencies**

Laboratory diagnostics of parasitic diseases, malaria, intestinal protozoosis, helminthiases.

Laboratory diagnostics of viral infections.

Laboratory diagnostics of emergency conditions.

## **Self-paced work**

Topics for self-study:

### Option 1

1. Modern technologies of hematological analysis. General characteristics of modern research methods used in hematology. Hematology analyzers (3Diff, 5 Diff).

2. Proteins of the acute phase of inflammation and markers of the inflammatory process.

3. Molecular-genetic methods of diagnosis of hereditary diseases.

### Option 2

1. Leukocytosis, leukopenia, leukemoid reactions. Hematological malignancies. Lymphoproliferative diseases.

2. Characterization, classification, metabolic disorders in lysosomal and mitochondrial diseases. Their diagnosis.

3. Laboratory diagnostics of infectious diseases (HIV, hepatitis). Prevention of occupational infection.

### Option 3

1. General clinical studies in diseases of the bronchopulmonary system.
2. Biochemical Basis of Hormonal Regulation in Normal and Pathological Conditions. Hormone research methods.
3. Biochemical, immunological, cytogenetic and molecular-genetic methods for diagnosing hereditary diseases.

Option 4

1. Anemias: hypochromic, normochromic, megaloblastic, hemolytic (etiology, pathogenesis, classification)
2. Clinical Enzymology: Enzyme Diagnostics, Enzymopathology, Enzyme Therapy.
3. Laboratory diagnostics of emergency conditions.

Option 5

1. Changes in blood and bone marrow in various pathological conditions
2. Biochemistry and pathochemistry of carbohydrates. Diseases of carbohydrate metabolism. Laboratory diagnostics of complications of diabetes mellitus.
3. Research Methods and Principles of Microbiological Studies of Biological Material

Option 6

1. General clinical studies in diseases of the digestive system.
2. Types of biochemical analyzers. Principles of operation of semi-automatic and automatic biochemical analyzer, enzyme-linked immunosorbent analyzer. Programming of work.
3. Laboratory diagnostics of skin and venereal diseases: syphilis, gonorrhoea, urogenital trichomoniasis, chlamydia, candidiasis

Option 7

1. General clinical studies in diseases of the urinary system.
2. Biochemical research methods and their importance in the diagnostic process.
3. Laboratory diagnostics of parasitic diseases: malaria, intestinal protozooses, helminthiasis.

Option 8

1. General clinical studies in diseases of the central nervous system.
2. Hypo- and hyperlipidemia. Dyslipoproteinemia. Lipidosis.
3. Enzyme-linked immunosorbent assay: areas of application in clinical and diagnostic practice. ELISA types, analyzer characteristics. Common mistakes.

Option 9

1. Cytological studies in neoplasms of the digestive system.
2. Metabolic syndrome as a complex of metabolic and hormonal disorders.



3. Algorithms for diagnosing autoimmune diseases of connective tissue, thyroid, pancreas, adrenal glands.

Option 10

1. General clinical studies in diseases of the female and male reproductive organs.

2. Biochemistry and pathochemistry of lipids. Lipid metabolism diseases.

3. PCR Analysis in Laboratory Practice: Principle, Basics of Work, Sample Preparation. PCR diagnostics of lung diseases, urogenital infections, human papillomavirus.

Option 11

1. Cytological studies in respiratory neoplasms.

2. Normal levels of hormones in the blood. Laboratory evaluation of hormonal functions. Study of the products of hormone metabolism in the urine.

3. Laboratory methods of studying the immune system. Tactics of immunolaboratory examination. Study of non-specific and specific immunoreactivity.

Option 12

1. Cytological studies in neoplasms of the urinary system.

2. Dyslipoproteinemia of atherogenic genesis. Biochemistry of the atherosclerotic process. The role of LP(a) in the pathogenesis of atherosclerosis.

3. Algorithms for diagnosing autoimmune diseases of the liver, kidneys, gastrointestinal tract, reproductive system.

Option 13

1. Cytological examinations for breast neoplasms.

2. Biochemistry of water-electrolyte metabolism. Basics of CBS. Methods for determining and meaning of CBS indicators.

3. Laboratory methods for assessing external and internal coagulation pathway factors (APTT, PTV/INR, mixed tests, poison tests), deficiency of individual coagulation factors.

Option 14

1. Cytological examinations for tumors and tumor-like lesions of the head and neck

2. Modern methods of laboratory diagnostics of bone marrow lesions in solid tumors (immunocytochemistry, PCR, flow cytometry, tissue culture method)

3. Laboratory diagnostics of thrombophilic conditions. Diagnostic criteria and clinical variants of thrombophilic conditions.

Option 15

1. Cytological examinations for neoplasms and other pathological processes in the lymph nodes.

2. Biochemical diagnostics of pancreatic diseases.

3. Principles and Methods of Laboratory Study of the Vascular-Platelet and Coagulation Links of the Hemostasis System. Conditions that ensure the accuracy and informative value of the study.

Option 16

1. Cytological studies in neoplasms of female and male genital organs.  
2. Mineral metabolism. Markers of bone tissue and osteoporosis. Methods for determining phosphorus-calcium mineral metabolism.

3. The main directions of laboratory examination of patients with clinical manifestations of hemostasis system disorders are the minimum and maximum volumes of diagnostic tests.

Option 17

1. Cytological studies of neoplasms of serous membranes.  
2. The role of the kidneys in maintaining the constancy of CBS. The role of the renin-angiotensin system. Cause of persistent hypertension in chronic kidney disease.

3. Clinical significance of the study of cellular and humoral factors of the immune system. Non-specific methods for assessing a person's immune status.

Option 18

1. Cytological studies for tumor metastases to the bone marrow.  
2. Analysis of kidney function in burrow and pathology. Laboratory diagnostics of glomerulonephritis, pyelonephritis, nephrotic syndrome, renal failure, nephrolithiasis, anuria.

3. Modern ideas about the system of hemostasis. Reference and diagnostic values of indicators for the assessment of the hemostasis system in various pathological conditions and syndromes.

Option 19

1. Modern methods of immunohistochemical studies.  
2. Biochemistry of water- and fat-soluble vitamins. Diagnosis of hyper- and hypovitaminosis.

3. Methods of diagnosing infectious diseases, laboratory tests. Interpretation of the results of serological diagnosis of viral hepatitis, herpes infection, infectious mononucleosis, cytomegalovirus infection.

Option 20

1. Computer Programs in Cytological Diagnostics.  
2. Impaired hepatic function. Inflammatory syndrome, cytolysis syndrome, excretory-biliary syndrome, hepatocellular insufficiency syndrome. Their biochemical diagnostics.

3. Immunological diagnosis of the tumor process, tumor markers.

## VI. MONITORING THE ACHIEVEMENT OF THE COURSE OBJECTIVES

Item No.	Supervised sections/topics of the discipline	Code and name of the indicator of achievement	Learning Outcomes	Evaluation Tools	
				Current control	Intermediate Certification
1	Organization of laboratory services	PP-6.1 Uses knowledge and methods of genetics, molecular and cellular biology to study living systems	<p>Knows Modern methods of genetics and molecular and cellular biology for the study of living systems.</p> <p>Can Conduct research in genetics and molecular and cellular biology to study living systems.</p> <p>Owns skills in the use of research methods in the field of genetics and molecular and cellular biology for the study of living systems.</p>	Colloquium	Exam Questions
2	Biochemical diagnostics of liver diseases			Colloquium	
3	Biochemical diagnostics of diseases of the pancreas and cardiovascular system	PC-6.2 Applies methods of genetics, molecular and cellular biology to identify the mechanisms of pathological processes	<p>Knows Methods of diagnosing pathological conditions.</p> <p>Can to use fundamental knowledge and biophysical methods to diagnose pathological conditions.</p> <p>Owns skills in the application of fundamental knowledge and biophysical methods for the diagnosis of pathological conditions.</p>	Test	
4	Biochemical Diagnosis of Kidney Diseases			Colloquium	
5	Biochemical Research Methods for Blood Diseases			Test	
6	General clinical and cytological research methods	PC-6.3 Able to develop clinical diagnostic systems using knowledge	<p>Knows Methods of diagnosing pathological conditions.</p> <p>Can</p>	Colloquium	

7	Immune System Research Methods	and methods of genetics, molecular and cellular biology	to use fundamental knowledge and biophysical methods to diagnose pathological conditions. Owns skills in the application of fundamental knowledge and biophysical methods for the diagnosis of pathological conditions.	Colloquium	
8	Features of Immune Status in Various Immunopathological Conditions	PC-6.4 Able to perform studies in the field of clinical laboratory diagnostics, molecular-genetic and cytological studies in order to identify the causes of the disease and make a diagnosis	Knows research methods in the field of clinical laboratory diagnostics, molecular-genetic and cytological research methods. Can perform research in the field of clinical laboratory diagnostics, molecular-genetic and cytological studies. Owns ability to perform studies in the field of clinical laboratory diagnostics, molecular-genetic and cytological studies in order to identify the causes of the disease and make a diagnosis.	Test	
9	Laboratory diagnostics of infectious diseases. Emergencies			Test	

## **VII. EDUCATIONAL AND METHODOLOGICAL SUPPORT OF STUDENTS' INDEPENDENT WORK**

### **Guidelines for writing and formatting an abstract**

Abstracting of educational and scientific literature involves an in-depth study of individual scientific works, which should ensure the development of the necessary skills for working on the book. All this will contribute to the expansion of scientific horizons, the improvement of their theoretical training, and the formation of scientific competence.

Textbooks, individual monographic studies and articles on issues provided for by the program of the academic discipline are offered for abstracting. When selecting literature on the chosen issue, it is necessary to cover the most important areas of development of this science at the present stage. Particular attention should be paid to those literary sources that (directly or indirectly) can help the specialist in his practical activities. However, this section also includes works and individual studies on issues that go beyond the discipline being studied. It is recommended to use this literature if you want to expand your knowledge in any branch of science.

Along with literature on general issues, students are supposed to read literature taking into account the profile of their professional activity, obtained independently. Not all the proposed literature is equal in content and volume, so different approaches to its study are possible. In one case, it can be a general abstract of several literary sources of different authors devoted to the consideration of the same issue, in the other case, it can be a detailed study and abstract of one of the recommended works or even its separate sections, depending on the degree of complexity of the issue (problematic). In order to decide what to do in each case, you should consult with the teacher.

The choice of a specific work for the abstract should be preceded by a detailed acquaintance with the list of all literature given in the curriculum of the discipline. It is recommended to first familiarize yourself with the selected work by looking at the subheadings, highlighted texts, diagrams, tables, and general conclusions. Then it is necessary to read it carefully and thoughtfully (delving into the ideas and methods of the author), making notes on a separate sheet of paper about the main provisions and key issues. After reading, you should think over the content of the article or a separate chapter, paragraph (if we are talking about a monograph) and briefly write it down. Only strict definitions and formulations of laws should be written out verbatim. Sometimes it's helpful to include one or two examples to illustrate. In the event that there are unclear passages, it is recommended to read the following exposition, as it can help to understand the previous material, and then return to the comprehension of the previous exposition.

The result of the work on literary sources is an abstract.

When preparing an abstract, it is necessary to highlight the most important theoretical provisions and substantiate them independently, paying attention not only to the result, but also to the methodology used in the study of the problem. Reading scientific literature should be critical. Therefore, it is necessary to strive not only to assimilate the main content, but also the method of proof, to reveal the features of different points of view on the same issue, to assess the practical and theoretical significance of the results of the reviewed work. A very desirable element of the abstract is the expression by the listener of his own attitude to the ideas and conclusions of the author, supported by certain arguments (personal experience, statements of other researchers, etc.).

As mentioned above, abstracts of monographs and journal articles of a research nature must contain a definition of the problem and specific objectives of the research, a description of the methods used by the author, as well as the conclusions that he came to as a result of the research. The proposed literature for abstracting is constantly updated.

Instructions for writing essays:

General requirements for the abstract:

The abstract should be written according to the standard scheme, including:

- Title page
- contents
- introduction
- Main part
- Conclusion of the E
- List of references.

It is desirable to include tables and (or) figures in the text of the abstract: diagrams, graphs. The volume of the abstract: 10-20 pages of A4 format computer layout in the Times New Roman editor, with 1.5 intervals, in 14 fonts. The title of the topic of the essay should fully correspond to the chosen option.

The structure of the abstract should meet the standard requirements for writing essays: introduction, justification for the choice of topic, presentation of the topic, conclusion. More detailed requirements for the written design of the abstract are presented in the Procedure "Requirements for the design of written works performed by FEFU students and attendees" [http://law.wl.dvgu.ru/docs/treb\\_2012.pdf](http://law.wl.dvgu.ru/docs/treb_2012.pdf)

Approximate list of abstract topics:

1. Mechanisms of energy production in mitochondria.
2. The liver is its role for the human body.
3. Alcoholism and drug addiction are metabolic disorders.
4. Influence of trace elements on enzyme activity.
5. Metabolic connections of the Krebs cycle.
6. Types of jaundice.

7. Biotransformation of xenobiotics in the body.
8. Cholesterol fund in the human body and ways of its consumption.
9. Biological role of iron, molybdenum and zinc.

### **Criteria and Indicators Used in the Evaluation of the Educational Essay**

Criteria	Indicators
1. Novelty of the abstracted text Max. - 5 points	- relevance of the problem and topic;- novelty and independence in the formulation of the problem, in the formulation of a new aspect of the problem selected for analysis;- the presence of the author's position, independence of judgments.
2. Degree of disclosure of the essence of the problem Max. - 5 points	- correspondence of the plan to the topic of the abstract;- correspondence of the content to the topic and plan of the abstract;- completeness and depth of disclosure of the main concepts of the problem;- validity of ways and methods of working with the material;- ability to work with literature, systematize and structure the material;- ability to generalize, compare different points of view on the issue under consideration, argue the main provisions and conclusions.
3. Reasonableness of the choice of sources Max. - 5 points	- the range and completeness of the use of literary sources on the problem;- attraction of the latest works on the problem (journal publications, materials of collections of scientific papers, etc.).
4. Compliance with Registration Requirements Max. – 5 points	- correct formatting of references to the literature used;- literacy and culture of presentation;- knowledge of terminology and conceptual apparatus of the problem;- compliance with the requirements for the volume of the abstract;- culture of design: highlighting paragraphs.
5. Literacy Max. - 5 points	- absence of spelling and syntax errors, stylistic errors;- absence of typos, abbreviations of words, except for generally accepted ones;- literary style.

### **Guidelines for Maintenance, Submission Requirements and Criteria for Evaluating the Outline**

A synopsis (from the Latin conspectus – review) is a written text in which the content of the main source of information is briefly and consistently stated. To take notes is to bring to some order the information gleaned from the original. The process is based on the systematization of what has been read or heard. Notes can be made both in the form of precise excerpts, quotations, and in the form of a free presentation of meaning. The manner of writing the synopsis, as a rule, is close to the style of the original source. If the synopsis is written correctly, it should reflect the logic and semantic connection of the information being recorded.

In well-made notes, it is easy to find specialized terminology that is clearly explained and clearly highlighted for memorizing the meanings of various words. Using the outline information, it is easier to create meaningful creative or scientific works, various essays and articles.

#### **Note-taking rules**

1. Read the text carefully. Along the way, mark incomprehensible places, new words, names, dates.

2. Make inquiries about the persons and events mentioned in the text. When recording, do not forget to put reference data in the fields.

3. When reading the text for the first time, make a simple outline. When re-reading, try to summarize the main points of the text, noting the author's arguments.

4. The final stage of note-taking consists of re-reading the previously marked passages and writing them down consecutively.

5. When taking notes, you should try to express the author's thought in your own words.

6. Strive to ensure that one paragraph of the author's text is conveyed in one, maximum two sentences.

**When taking notes of lectures, it is recommended to adhere to the following basic rules.**

1. Do not start writing down the material from the first words of the teacher, first listen to his thought to the end and try to understand it.

2. Start writing at the moment when the teacher, having finished the presentation of one idea, begins to comment on it.

3. In the synopsis, it is necessary to highlight individual parts. It is necessary to distinguish between headings, subheadings, conclusions, to separate one topic from another. Selection can be done with an underline or a different color (just don't turn the text into colorful pictures). It is recommended to indent paragraphs and points of the plan, white lines to separate one thought from another, and numbering. If definitions, formulas, rules, and laws can be made more visible in the text, they are framed. Over time, you'll have your own selection system.

4. Create your entries using accepted conventions. When taking notes, be sure to use a variety of signs (they are called signal signs). These can be pointers and directional arrows, exclamation and question marks, combinations PS (afterword) and NB (pay attention). For example, you can denote the word "therefore" with a mathematical arrow  $\Rightarrow$ . Once you've developed your own character set, it's easier and faster to create an outline and then study it.

5. Don't forget about abbreviations (abbreviated words), equal and inequality signs, more and less.

6. Abbreviations are very useful for creating a correct outline. Be careful, though. Connoisseurs believe that abbreviations such as "d-t" (to think) and similar ones should not be used, since later a large amount of time is spent on deciphering, and after all, the reading of the synopsis should not be interrupted by extraneous actions and reflections. The best thing to do is to develop your own system of abbreviations and use them to denote the same words (and nothing else) in all entries. For example, the abbreviation



"g-t" will always and everywhere be the word "to speak," and the capital "P" will be the word "work."

7. Undoubtedly, foreign words will help to organize a good synopsis. The most common among them are English. For example, the abbreviated "ok" successfully denotes the words "excellent", "wonderful", "good".

8. Complex and lengthy reasoning should be avoided.

9. When taking notes, it is better to use declarative sentences, avoid independent questions. Questions are appropriate in the margins of the outline.

10. Do not try to record the material verbatim, in this case the main idea is often lost, and it is difficult to keep such a record. Discard secondary words, without which the main idea is not lost.

11. If there are terms in the lecture that you do not understand, leave a place, clarify their meaning with the teacher after the lesson.

#### **Evaluation criteria:**

86-100 points are given to the student if the abstract is presented in the most understandable form, has a plan, schemes and drawings in the structure, reveals all the basic concepts and questions given above;

76-85 points are given to the student if the abstract is presented in a sufficiently understandable form, has schemes and/or drawings in the structure, reveals more than half of the main concepts and questions;

75-61 points are given to the student if the abstract is presented in a relatively understandable form and reveals half of the main concepts and questions;

60-50 points are given to the student if the outline is presented in an incomprehensible form and reveals less than half of the main concepts and questions.

## **VIII. LIST OF EDUCATIONAL LITERATURE AND INFORMATIONAL AND METHODOLOGICAL SUPPORT OF THE DISCIPLINE**

### Reference citations

1. Novikova I. A. Vvedenie v klinicheskoy laboratorinuyu diagnostiku: uchebnoe posobie [Introduction to clinical laboratory diagnostics: textbook]. - Minsk: Vysheishaya shkola, 2018. — 368 c. — ISBN 978-985-06-2913-5. — Text : electronic // Digital educational resource IPR SMART : [site]. — URL: <https://www.iprbookshop.ru/90748.html>

2. Novikova I. A. Klinicheskaya laboratornaya diagnostika: uchebnoe posobie [Clinical laboratory diagnostics: textbook]. - Minsk: Vysheishaya shkola, 2020. — 208 c. — ISBN 978-985-06-3184-8. — Text : electronic // Digital educational resource IPR SMART : [site]. — URL: <https://www.iprbookshop.ru/119989.html>

3. Borisevich S. N. Laboratornaya diagnostika ostrykh poisoning: uchebnoe posobie [Laboratory diagnostics of acute poisoning: textbook]. - Minsk: Vysheishaya shkola, 2016. — 224 c. — ISBN 978-985-06-2626-4. — Text : electronic // Digital educational resource IPR SMART : [site]. — URL: <https://www.iprbookshop.ru/90786.html>

4. Borisevich S. N. Metody laboratornoy diagnostiki ostrovykh poisoning: uchebnyk [Methods of laboratory diagnostics of acute poisoning: textbook]. - Minsk: Vysheishaya shkola, 2022. — 232 c. — ISBN 978-985-06-3468-9. — Text : electronic // Digital educational resource IPR SMART : [site]. — URL: <https://www.iprbookshop.ru/129990.html>

5. Novikova I. A., Khoduleva S. A. Klinicheskaya i laboratornaya hematologiya: uchebnoe posobie [Clinical and laboratory hematology: textbook]. - Minsk: Vysheishaya shkola, 2013. — 447 c. — ISBN 978-985-06-2226-6. — Text : electronic // Digital educational resource IPR SMART : [site]. — URL: <https://www.iprbookshop.ru/24061.html>

#### Further reading

1. Osnovy laboratornoy diagnostiki: uchebno-metodicheskoe posobie dlya sistemy postvuzovskogo professional'nogo obrazovaniya [Fundamentals of laboratory diagnostics: educational and methodological manual for the system of postgraduate professional education] / R. F. Khamitov [i dr.]; State Educational Institution of Higher Professional Education "Kazan. State Med. Feder University. Health and Social Welfare Agencies. development". [2nd ed., revised and revised] . Kazan: [Brig], 2009.? 134 p. : ill., col. silt. ; 20 . References: p. 133-134 (21 titles) .? ISBN 978-5-98946-025-0, 500.

2. Osnovy laboratornoy diagnostiki v klinike vnutrennykh boleznykh : uchebno-spravochnoe posobie dlya studentov [Fundamentals of laboratory diagnostics in the clinic of internal diseases: educational and reference manual for students]; State Educational Institution of Higher Professional Education "Kazan. State Med. Feder University. Health and Social Welfare Agencies. development". [3rd ed., revised and revised] .? Kazan: [KSMU], 2010. 98 p. : ill. ; 21 . References: p. 98 (16 titles), 150.

3. Osnovy laboratornoy diagnostiki: uchebnoe posobie dlya sistemy postvuzovskogo i dopolnitel'nogo professional'nogo obrazovaniya vrachov [Fundamentals of laboratory diagnostics: textbook for the system of postgraduate and additional professional education of doctors]. Budget. Education. Institution of Higher Education. Prof. of Education "Kazan. State Med. Un-t" M-va zdravookhraneniye Ros. Federation, Caf. Int. diseases 2 ; [comp.] R. F. Khamitov [et al.] .? [2nd ed., revised and revised] . Kazan: [Brig], 2013.? 141, [1] p. : ill., col. silt. ; 21 . Refs. At the end of the book. (15 titles).? ISBN 978-5-98946-090-8 ((in obl.) ) , 100 .? Fragment of the book.

4. Kishkun A.A. Klinicheskaya laboratornaya diagnostika: uchebnoe posobie [Clinical laboratory diagnostics: textbook]. Moscow: GEOTAR-Media, 2010. - 976 p. : ill. <http://www.studmedlib.ru/ru/book/ISBN9785970415504.html>

Khaitov R.M., Pinegin B.V., Yarilin A.A. Manual of Clinical Immunology. Diagnosing Diseases of the Immune System: A Guide. Khaitov, R.M., Pinegin, B.V., Yarilin, A.A. 2009. - 352 p. (in Russian). <http://www.studmedlib.ru/ru/book/ISBN9785970409176.html>

List of resources of the information and telecommunication network "Internet"

1. <http://elibrary.ru/> - Scientific Electronic Library
2. <http://molbiol.ru/> - Molecular Biology Information Resource
3. <http://macroevolution.narod.ru/> is an electronic resource on evolutionary biology.
4. <http://science.km.ru/> - electronic resource on different sections of biology
5. <http://elementy.ru/> is an informational and educational resource dedicated to natural sciences.
6. <http://www.iprbookshop.ru/> is **the IPRbooks electronic library system.**
7. <http://znanium.com/> - EBS "Znanium".
8. <https://nplus1.ru/> - N+1, a popular science online publication about science, engineering and technology
9. <http://antropogenez.ru/> is a popular science information resource about human evolution
10. <http://web.a.ebscohost.com/ehost/search/basic?sid=851485f8-6200-4b3e-aaab-df4ba7be3576@sessionmgr4008&vid=1&tid=2003EB> is a collection of books on various sections from the EBSCOhost database.
11. <http://rosalind.info/problems/locations/>- resource for self-study of bioinformatics Rosalind.
12. <http://www.ncbi.nlm.nih.gov/> website of the- National Center for Biotechnology Information (NCBI).
13. <http://www.mendeley.com/>- *Mendeley*: Free reference manager and PDF organizer; Librarian Program.
14. <http://www.ebi.ac.uk/>- website of the European Bioinformatics Institute
15. <http://www.scopus.com> – Scopus bibliographic database and citation index
16. <http://thomsonreuters.com/thomson-reuters-web-of-science/> Web of Science bibliographic database and citation index

List of information technologies and software

1. Microsoft Office Professional Plus 2013 is an office suite that includes software for working with various types of documents (texts, spreadsheets, databases, etc.);

2. 7Zip 16.04 - free file archiver with high data compression ratio;
3. Adobe Acrobat XI Pro is a software package for creating and viewing electronic publications in PDF format;
4. ESET Endpoint Security 5 is a comprehensive protection solution for Windows-based workstations. Virtualization support + new technologies;
5. WinDjView 2.0.2 is a program for recognizing and viewing files with the same DJV and DjVu formats; SolidWorks 2016 is a CAD software package for automating the work of an industrial enterprise at the stages of design and technological preparation of production
6. Notepad++ 6.68 – Text Editor

## **IX. METHODOLOGICAL INSTRUCTIONS FOR MASTERING THE DISCIPLINE**

### **Lecture**

**The lecture is the** main active form of classroom classes, the explanation of the fundamental and most difficult theoretical sections of molecular biology and the theory of genetic engineering, which involves intensive mental activity of the student and is especially important for mastering the subject. A lecture should always be cognitive, developmental, educational and organizing. Lecture notes help to assimilate the theoretical material of the discipline. When listening to a lecture, you need to take notes main information, preferably with your own wording, which allows you to better remember the material. An outline is useful when it is written by the student independently.

In the lecture, the teacher gives only a small part of the material on certain topics that are presented in the textbooks. In addition, the instructor informs students about what additional information can be obtained on the topics discussed, and from what sources. Therefore, when working with lecture notes, it is always necessary to use the main textbooks, additional literature and other recommended sources on this discipline. It is this serious work of the student with the lecture material that allows him to achieve success in mastering new knowledge.

To present a lecture course on the discipline "Methods of Clinical Diagnostics", the following are used as forms of active learning: lecture-conversation, lecture-visualization, which are built on the basis of knowledge received by students in the framework of subjects preceding the course. Electronic presentations, tables, video files, and blackboard diagrams are used to illustrate verbal information. In the course of the lecture material, problematic questions or questions with elements of discussion are posed.

### **Lecture – visualization**

The lecture is accompanied by the demonstration of tables, electronic presentations, video files - such a combination of ways of presenting information significantly simplifies its mastering by students. Verbal presentation of the material should be accompanied and combined with the visual form. The information presented in the form of diagrams on the board, tables, slides allows you to form problematic questions, and contribute to the development of professional thinking of future specialists.

### **Lecture-conversation**

Lecture-conversation, "dialogue with the audience", is the most common form of active learning and allows students to be involved in the educational process, since there is direct contact between the teacher and the audience. Such contact is achieved during the lecture, when students are asked questions of a problematic or informational nature, or when they are invited to ask the teacher questions themselves. Questions are offered to the entire audience, and any of the students can offer their own answer; another can complement it. In the course of the educational process, this allows you to identify the most active students and activate those who do not participate in the work. This form of lecture allows you to involve students in the work process, attract their attention, stimulate thinking, gain collective experience, and learn how to form questions. The advantage of a lecture-conversation is that it allows you to draw students' attention to the most important issues of the topic, determine the content and pace of the presentation of educational material, as well as determine the topics that are most interesting to students, in order to possibly adjust the form of the material taught.

### **Labs**

They are used for conducting experiments, observations of phenomena and processes by students mainly in special laboratories, classrooms and with the use of technical means. This method stimulates action both in the preparation for research and in the process of its implementation. Laboratory work improves the quality of education, contributes to the development of cognitive activity in students, their logical thinking and creative independence. In the process of laboratory work, theoretical knowledge is deepened and concretized, and the ability to apply it in practice is developed. Skills in working with microscopes, tables and atlases are acquired. The student learns to analyze the data obtained, identify the norm and deviation from it, acquires the skills of working with a living object and physiological measuring devices, performing operations, conducting a comparative analysis, summarizing the material obtained and drawing conclusions. All this allows for a deeper understanding of the mechanisms of the functioning of a living organism and the principles of its interaction with the environment. Research skills and professional competencies are formed.

Traditionally, laboratory classes are the main type of training aimed at experimental confirmation of theoretical positions. In the course of a laboratory lesson, students perform one or more laboratory works (tasks) under the guidance of a teacher

in accordance with the content of the educational material being studied. Students perform laboratory work aimed at:

- generalization, systematization, deepening of theoretical knowledge on specific topics of the academic discipline;
- formation of skills to accept the acquired knowledge in practical activities;
- development of analytical, design and constructive skills;
- development of independence, responsibility and creative initiative.

Necessary structural elements of the laboratory lesson:

- instruction given by the teacher;
- independent activities of students;
- Discussion of the results of the laboratory work (task).

Before completing the laboratory task (work), the students' knowledge is tested, i.e. their theoretical readiness to perform the task.

**A laboratory task (work) can be reproductive, partially exploratory and exploratory in nature.**

Works of a **reproductive** nature are distinguished by the fact that when conducting them, students use detailed instructions, which indicate: the purpose of the work, explanations (theory, main characteristics), equipment, apparatus, materials and their characteristics, the procedure for performing the work, tables, conclusions (without formulations), control questions, educational and special literature.

The works, which are of a **partial-exploratory** nature, are distinguished by the fact that during the conduct of the works, students do not use detailed instructions, they are not given the order of performing the necessary actions, students are required to independently select equipment, choose ways to perform work, instructive and reference literature.

**Exploratory** works are distinguished by the fact that students have to solve a problem that is new to them, relying on their theoretical knowledge.

The forms of organization of students for conducting a laboratory lesson - frontal, group and individual - are determined by the teacher, based on the topic, goal, and order of work. In the frontal form of organizing classes, all students do the same work. In the group form of organizing classes, the same work is carried out in teams of 2-5 people. With an individual form of organizing classes, each student performs an individual task.

The results of the laboratory task (work) are drawn up by students in the form of a report, the grades for the performance of the laboratory task (work) are indicators of the current performance of students in the academic discipline.

Research skills and professional competencies are formed.

### **Colloquia**

Colloquium is a collective form of consideration and consolidation of educational material. Colloquia is one of the types of practical classes designed for in-depth study of the discipline, held in an interactive mode. In the classes on the topic of

the colloquium, questions are analyzed, and then, together with the teacher, they are discussed, which is aimed at consolidating the material, forming polemic skills, developing independence and critical thinking, the ability of students to navigate in large information flows, to develop and defend their own position on problematic issues of the academic discipline.

As methods of interactive learning at colloquiums, the following are used: an extended conversation, a dispute, a press conference.

**An extended conversation involves the** preparation of students on each issue of the lesson plan with a single list of recommended mandatory and additional literature. Reports are prepared by students on a pre-proposed topic.

A dispute in a group has a number of advantages. A dispute can be caused by the teacher during the lesson or planned by him in advance.

**Press conference. The teacher** assigns several students to prepare short (thesis) reports. After the presentations, students ask questions, which are answered by the speakers and other members of the expert group. Based on the questions and answers, a creative discussion unfolds together with the teacher.

**Case study method.**The case-study method is a method of active problem-situational analysis based on learning by solving specific problems (case solving). The method of specific situations (case-study method) refers to non-game imitation active teaching methods and is considered as a tool that allows you to apply theoretical knowledge to solving practical problems. At the end of the lesson, the teacher tells a series of situations and offers to find solutions for those problems that are voiced in them. At the same time, the problem itself does not have unambiguous solutions. Students must analyze the situation, understand the essence of the problems, propose possible solutions and choose the best one. Thanks to the knowledge gained at the lecture, it is easy for the student to correlate the theoretical knowledge received with a real practical situation. As an interactive teaching method, it gains a positive attitude from students, who see it as an opportunity to take the initiative, feel independent in mastering theoretical provisions and mastering practical skills. No less important is the fact that the analysis of situations has a strong impact on the professionalization of students, contributes to their maturation, forms interest and positive motivation for learning. The method is aimed not so much at mastering specific knowledge or skills, as at developing the general intellectual and communicative potential of the student and the teacher.

It is a learning method designed to improve skills and gain experience in the following areas:

- identifying, selecting and solving problems;
- working with information – comprehending the meaning of the details described in the situation;
- analysis and synthesis of information and arguments;

- working with assumptions and conclusions;
- evaluation of alternatives;
- decision-making;
- Listening to and understanding other people is a group work skill. The

main function of the case method is to teach students to solve complex unstructured problems that cannot be solved in an analytical way. The case activates students, develops analytical and communicative skills, leaving students face to face with real situations.

*The case* study is designed to increase the effectiveness of educational activities: as an illustration for solving a certain problem, explaining a particular phenomenon, studying the features of its manifestations in real life, developing competence aimed at solving various life and work situations (the use of the case involves individual and group work of students).

**Brainstorming** is a widely used way of generating new ideas to solve scientific and practical problems. Its goal is to organize collective thinking to find non-traditional ways to solve problems.

The use of the brainstorming method in the educational process allows you to solve the following tasks:

- creative assimilation of educational material by students;
- connection of theoretical knowledge with practice;
- • activation of educational and cognitive activities of students;
- formation of the ability to concentrate attention and mental efforts on the solution of an urgent task;
- formation of the experience of collective thinking activity.

The problem formulated in the brainstorming class should have theoretical or practical relevance and arouse the active interest of students. A common requirement that must be taken into account when choosing a problem for brainstorming is the possibility of many ambiguous solutions to the problem, which is put forward to students as a learning task.

### **Quizzes & Testing**

Current control of material assimilation is assessed by oral answers, tests, as well as paper testing.

Assessments of laboratories, colloquiums, tests and testing mainly form the grade for this discipline.



## MATERIAL AND TECHNICAL SUPPORT OF DISCIPLINE

### Logistical and software of the discipline

Name of special rooms and rooms for independent work	Equipment of special rooms and rooms for independent work	List of licensed software. Details of the supporting document
<p>Lecture hall: 690922, Primorsky Krai, Vladivostok, Russky Island, Saperny Peninsula, Ajax village, 10, aud. M 421</p>	<p>DLP projector, 3000 ANSI Lm, WXGA 1280x800, 2000:1 EW330U Mitsubishi; CORSA-2007 Tuarex Specialized Equipment Fastening Subsystem; Video Switching Subsystem: Extron DXP 44 DVI Pro DVI Matrix Switcher; Extron DVI 201 Tx/Rx twisted-pair DVI extender Audio switching and sound amplification subsystem; Extron SI 3CT LP Ceiling Mount Speaker System Extron DMP 44 LC Digital Audio Processor; extension for IPL T CR48 control controller.</p>	<p>Windows Seven Enterprise SP3x64 (Microsoft License Number Standard Enrollment 62820593. End date: 2020-06-30. Campus 3 Parent Program 49231495. Reseller: JSC "Softline Trade" Reseller Order Number: Tr000270647-18.) Eset NOD32 Antivirus 4.2.76.1 (Contract No. EA-091-18 dated 24.04.2018. Microsoft Office 2010 Professional Plus 14.0.6029.1000 (Microsoft License Number Standard Enrollment 62820593. End Date 2020-06-30. Parent Program Campus 3 49231495. Reseller: JSC "Softline Trade" Reseller Order Number: Tr000270647-18.) Microsoft Office Professional Plus 2013 15.0.4420.1017 (Microsoft License Number Standard Enrollment 62820593. End Date 2020-06-30. Parent Program Campus 3 49231495. Reseller: JSC "Softline Trade" Reseller Order Number: Tr000270647-18.) Google Chrome 42.0.2311.90 (Free Software)</p>
<p>Computer class of the School of Biomedicine aud. M723, 15 workplaces</p>	<p>Electric Screen 236*147cm Trim Screen Line; DLP projector, 3000 ANSI Lm, WXGA 1280x800, 2000:1 EW330U Mitsubishi; CORSA-2007 Tuarex Specialized Equipment Fastening Subsystem; Video Switching Subsystem: Extron DXP 44 DVI Pro DVI Matrix Switcher; Extron DVI 201 Tx/Rx twisted-pair DVI extender Audio switching and sound amplification</p>	<p>Microsoft Office Professional Plus 2013 is an office suite that includes software for working with various types of documents (texts, spreadsheets, databases, etc.); 7Zip 16.04 - free file archiver with high data compression ratio; Adobe Acrobat XI Pro is a software package for creating and viewing electronic publications in PDF format; AutoCAD Electrical 2015 - three-dimensional computer-aided design and drafting system; ESET Endpoint Security 5 is a comprehensive protection solution</p>

	<p>subsystem; Extron SI 3CT LP Ceiling Mount Speaker System Extron DMP 44 LC Digital Audio Processor; extension for IPL T CR48 control controller; Wireless LAN for students is provided by a system based on 802.11a/b/g/n 2x2 MIMO(2SS) access points. Моноблок HP ProOne 400 All-in-One 19.5 (1600x900), Core i3-4150T, 4GB DDR3-1600 (1x4GB), 1TB HDD 7200 SATA, DVD+/-RW, GigEth, Wi-Fi, BT, usb kbd/mse, Win7Pro (64-bit)+Win8.1Pro(64-bit), 1-1-1 Wty</p>	<p>for Windows-based workstations. Virtualization support + new technologies; WinDjView 2.0.2 is a program for recognizing and viewing files with the same DJV and DjVu formats; SolidWorks 2016 is a CAD software package for automating the work of an industrial enterprise at the stages of design and technological preparation of production Compass-3D LT V12 - Three-Dimensional Simulation System Notepad++ 6.68 – Text Editor</p>
<p>Classrooms for self-study: Reading rooms of the FEFU Scientific Library with open access to the collection (building A - level 10)</p>	<p>HP RgoOpe 400 All-in-One 19.5 (1600x900), Core i3-4150T, 4GB DDR3-1600 (1x4GB), 1TB HDD 7200 SATA, DVD+/-RW, GigEth, Wi-Fi, VT, usb kbd/mse, Win7Pro (64-bit)+Win8.1Pro(64-bit), 1-1-1 Wty Internet access speed 500 Mbps. Workplaces for people with disabilities are equipped with displays and Braille printers; equipped with: portable devices for reading flat-printed texts, scanning and reading machines, a video magnifier with the ability to adjust color spectrums; magnifying electronic magnifiers and ultrasonic markers.</p>	<p>Windows Seven Enterprise SP3x64 (Microsoft License Number Standard Enrollment 62820593. End date: 2020-06-30. Campus 3 Parent Program 49231495. Reseller: JSC "Softline Trade" Reseller Order Number: Tr000270647-18.) Eset NOD32 Antivirus 4.2.76.1 (Contract No. EA-091-18 dated 24.04.2018. Microsoft Office 2010 Professional Plus 14.0.6029.1000 (Microsoft License Number Standard Enrollment 62820593. End Date 2020-06-30. Parent Program Campus 3 49231495. Reseller: JSC "Softline Trade" Reseller Order Number: Tr000270647-18.) Microsoft Office Professional Plus 2013 15.0.4420.1017 (Microsoft License Number Standard Enrollment 62820593. End Date 2020-06-30. Parent Program Campus 3 49231495. Reseller: JSC "Softline Trade" Reseller Order Number: Tr000270647-18.) Google Chrome 42.0.2311.90 (Free Software)</p>
<p>Classrooms for practical and laboratory work:</p>	<p>Laboratory of Biochemistry:</p>	

<p>690922, Primorsky Krai, Vladivostok, Russky Island, Saperny Peninsula, Ajax village, 10, aud. M 432, 431</p>	<p>Dry-air thermostat MIR-262; Pioneer Precision Scales (PA413); Laboratory centrifuge LMC-4200R; MSH-300i Magnetic Stirrer with Thermal Regulation; Distiller GFL-2008; Electric stove Mechta 111H; Spectrophotometer with BioSpectrometer-kinetic Sample Processing Accessories Mkmed-5 medical microscope, Hematology Analyzer XP-300 Panchenkov's apparatus Goryaev's Chamber Laboratory counter S-5 DocUReader 2 Pro Urine Analyzer Photometer KFK-Z-01— "ZOMZ" photovoltaic Wash StatFax 2600 Shaker Thermostat ST-3M Medical Photometers for iMark microplates</p>	
---	---	--