



MINISTRY OF EDUCATION AND SCIENCE OF THE RUSSIAN FEDERATION  
Federal state autonomous educational institution  
of higher education  
**«Far Eastern Federal University»**  
(FEFU)

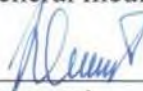
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**SCHOOL OF BIOMEDICINE**

«AGREED»

Head of education program  
«General medicine»

  
\_\_\_\_\_  
(signature) Khotimchenko Yu.S.  
(Full name)  
«09» of July 2019

«APPROVED»

Director of the Department of Clinical  
Medicine



  
\_\_\_\_\_  
(signature) Geltser B.I.  
(Full name)  
«09» of July 2019

**WORKING PROGRAM OF ACADEMIC DISCIPLINE (WPAD)**

**«Modern Laboratory Technologies and Complex»**

Education program

Specialty 31.05.01 «General medicine»

**Form of study: full time**

year 3, semester 6  
lectures 18 hours  
practical classes 36 hours  
laboratory works not provided  
total amount of in-classroom works 54 hours  
independent self-work 54 hours  
control works ()  
credit year 3, semester 6  
exam not provided

The working program is drawn up in accordance with the requirements of the Federal state educational standard of higher education (level of training), approved by the order of the Ministry of education and science of the Russian Federation from 09.02.2016 № 95.

The working program of the discipline was discussed at the meeting of the Department of fundamental and clinical medicine. Protocol No. 8, 09 of July 2019

Author: d.m.sc., professor Serebryanaya N.B.

## ANNOTATION

The discipline "Modern Laboratory Technologies and Complexes" is intended for students enrolled in the educational program of higher education on 31.05.01 "Medicine", is included in the optional part of the curriculum by the discipline of choice, is implemented on the 3rd course in the 6 semester. The total complexity of the discipline is 108 hours, 3 credit units.

In developing the work program of the discipline, the Federal State Educational Standard of Higher Education in the specialty 31.05.01 "Medical care" (specialty level) has been used.

The course program is based on the basic knowledge gained by students: the willingness to solve common tasks of professional activity with the use of information and bibliographic resources, biomedical terminology, information and communication technologies, taking into account the main requirements for information security (GPC – 1);

- the readiness to use basic physical and chemical, mathematical and other natural science concepts and methods in solving professional problems (GPC – 7);

**The purpose** of the discipline studying is the formation of professional competence in the field of knowledge of the discipline "Modern laboratory systems and complexes", which will allow students to evaluate and identify in samples of biomaterial the deviations caused by the structural and functional disorders of the state and activities of various organs, tissues, systems of the body.

The **objectives** of the discipline are:

- knowledge of modern methods of laboratory examination of patients, their diagnostic capabilities;
- mastering the technique of collecting biological material for laboratory research
- knowledge of algorithms for laboratory diagnostics of various diseases in the clinic of internal diseases, pediatrics, surgical pathology.

- ability to interpret the results of laboratory studies, including taking into account the continuity of outpatient, inpatient, laboratory, preoperative examination;
- making a plan of laboratory examination taking into account the features of laboratory tests.
- mastering the methods of bedside diagnostics using "dry chemistry".

As a result of the study of the discipline "Modern laboratory systems and complexes" students form the following general cultural/ general professional/ professional competence (elements of competence).

Competence and its code	Stages of competence formation	
- the capacity for the assessment of morphological and physiological states and pathological processes in the human body for solving professional tasks (GPC – 9)	Knows	The structure and functioning of the human body in the normal and pathology, identified by laboratory diagnostics.
	Able to	Using the methods of laboratory diagnostics to determine the structure and function of human organs in normal and pathological conditions.
	Masters	The basics of determining the structure and function of human organs in the norm and pathology, identified by methods of laboratory diagnosis.
the readiness to collect and to analyze patient complaints, data of its history, the results of laboratory, instrumental, postmortem and other examinations to recognize the incidence or the absence of diseases (PC – 5)	Knows	Modern methods of clinical, laboratory, instrumental examination of patients, their diagnostic capabilities;
	Able to	justify the need for clinical and laboratory examination of the patient identify and analyze clinically relevant information obtained in the laboratory examination of patients; morphological analysis of biopsy, surgical and sectional material
	Masters	Skills for interpretation of the results of laboratory studies, morphological descriptions of biopsy, operational and sectional material Skills for competent registration of the medical history in the section of appointment of laboratory examination and interpretation of its results.
the ability of determining the patient's basic pathological conditions , symptoms, syndromes, diseases in accordance with the International	Knows	pathophysiological characteristics of the main clinical syndromes and their parameters described by the results of laboratory studies
	Able to	to substantiate pathogenetically justified methods (principles) of diagnostics among adults and adolescents, taking into account their age and gender groups

Statistical Classification of Diseases and problems related to health , the 10th review. (PC – 6)	Masters	<ul style="list-style-type: none"> <li>- interpretation of the results of laboratory methods of diagnostics</li> <li>- technique of biological material collection for laboratory studies in children, adolescents and adults;</li> <li>- methods of assessing the effectiveness of therapy on the results of laboratory monitoring of informative parameters</li> </ul>
	Masters	<ul style="list-style-type: none"> <li>- to diagnose diseases and pathological processes taking into account the results of clinical and immunological examination</li> <li>- methods of bedside diagnosis (glucose determination, the use of urinary strips, allergodiagnosics) using " dry chemistry»</li> </ul>

The following methods of active/ interactive learning are used to form the above competences within the discipline "Modern laboratory systems and complexes": problem lecture, discussion.

## **I. THE STRUCTURE AND CONTENT OF THE THEORETICAL PART OF THE COURSE (14 hours)**

### **Section 1. Laboratory systems and complexes in various medical institutions**

**Theme 1. Types of diagnostic laboratory complexes and organization of laboratory studies. Standardization of research in the laboratory. Evaluation of the analytical reliability of the test: correctness, reproducibility, specificity and sensitivity of the methods. Preanalytical phase laboratory research (2 hrs.)**

Rules for obtaining biomaterials for biochemical, immunological, genetic, bacterioscopic, bacteriological studies. Vacuum blood collection system. Requirements for patient preparation, collection, storage, transportation of biological material.

Factors affecting the result of the analysis. Quality control of laboratory tests and the basis of statistical processing of the results.

**Theme 2. The system of laboratory studies in intensive care units and at the patient's place of treatment (immunochromatographic rapid diagnosis. (ICRD) (2 hours.) "Problem lecture".**

Emergency conditions and diseases. Emergency laboratory tests. Organization of urgent laboratory tests. Rapid tests. Laboratory studies in shock, shocking organs, multiple organ failure syndrome. Diagnosis of the acid-base metabolism state, oxygen transport, water-electrolyte metabolism, energy metabolism of the patient. Immunochromatographic rapid diagnosis (ICRD), analysis at the place of medical care, bedside diagnosis. Quantitative and qualitative methods of IED. Performance characteristics of rapid tests. Diagnosis of myocardial infarctions, allergies, infections, etc.

## **Section 2. Complex laboratory studies in the pathology of various organs and systems of the body**

### **Theme 3. Complex hematological, hematological analyzer, metrics in reactive and inflammatory conditions (2 hours)**

Changes in hematological parameters in reactive and inflammatory conditions. Diagnostic algorithm of diseases associated with changes in the number and properties of red blood cells, white blood cells and platelets. The role and place of general clinical studies in diagnostic algorithms of various nosological forms. Erythrocyte and platelet indices counted by hematological analyzers, their diagnostic value.

### **Theme 4. Complex coagulative laboratory studies. Methods of platelet-vascular hemostasis investigation. Thrombotic conditions. Methods of monitoring of disaggregant therapy (2 hours)**

Methods of studying coagulation hemostasis, aggregometry, thromboelastography. Indicators of external, internal pathways and stages of coagulation. Methods for determining coagulation factors and differential diagnosis of hemophilia. Methods of platelet-vascular hemostasis evaluation, types of thromboelastogram and aggregatogram. Control of disaggregated therapy. Markers of thrombosis, DIC syndrome, antiphospholipid syndrome. The patients with mesenchymal dysplasia. Methods of investigation of anticoagulant hemostasis and fibrinolysis. The criterion of fibrinolysis activation.

**Theme 5. Complex biochemical studies in liver and kidney diseases. (2 hours).**

Disturbances of the hepatocyte integrity: cytolysis syndrome, increased permeability, hyperfermentemia. Excretory-biliary syndrome: the ratio of enzyme activity and bilirubin fractions. Inflammatory syndrome: total serum and blood protein and protein fractions, types of proteinograms. Enzymodiagnosics of liver diseases. The algorithm of differential diagnostics 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. Physiological and pathological components of urine, methods of their determination. Clinical and diagnostic value of urea, creatinine and uric acid. Microalbuminuria and proteinuria.

**Theme 6. Complex laboratory study of water-electrolyte and mineral metabolism disorders. Acid-alkaline balance of the body and its disorders. (2 hours).**

Diagnostics of the water-electrolyte and mineral metabolism disorders. Mechanisms of the edema development in case of insufficiency of the cardiovascular system and kidney diseases. Hyper- and hypopotassiumemia, clinical manifestations. Calcium, hyper- and hypocalcemia in children and adults. Hyper- and hypophosphatemia in children and adults. Methods of determination of indicators of mineral exchange. Markers of bone metabolism and osteoporosis. Clinical and diagnostic value of indicators of acid-base balance of blood. Forms of the acid-base state disturbances. Laboratory diagnosis of critical conditions.

**Theme 7. Comprehensive laboratory study of the immune status in allergic and autoimmune diseases. (2 hours)**

Laboratory evaluation of humoral and cellular immunity, inflammatory mediators and apoptosis. Immune status in immunodeficiency, autoimmune and oncological diseases. Specific diagnostics. Evaluation of the effectiveness of immunocorrective therapy. Immune status in systemic and organ-specific autoimmune diseases. Principles of laboratory diagnostics of AID immunological strategies of treatment (correction, prevention) of autoimmune diseases.

## **II. THE STRUCTURE AND CONTENT OF THE PRACTICAL PART**

### **Practical classes (36 hours)**

**Theme 1. Types of diagnostic laboratory complexes and organization of laboratory studies. Standardization of research in the laboratory. Evaluation of the analytical reliability of the tests: correctness, reproducibility, specificity and sensitivity of the methods. Preanalytical phase of laboratory studies (4 hours.)**

Types and structure of laboratory complexes of medical-diagnostic and medical-scientific institutions.

Technological process of laboratory studies.

Rules for obtaining biomaterial for biochemical, immunological, genetic, bacterioscopic, and bacteriological studies.

Requirements for patient preparation, collection, storage, transportation of biological material.

Quality control of laboratory tests and the basis of statistical processing of the results.

**Theme 2. The system of laboratory studies in intensive care units and at the patient's place of treatment (immunochromatographic rapid diagnosis. ICRD) (4 hours.)**

**"Problem lecture". (4 hours.)**

Emergency conditions and diseases. Emergency laboratory tests. Organization of urgent laboratory tests. Rapid tests. Laboratory studies in shock, shocking organs, multiple organ failure syndrome. Diagnostics of the acid-base metabolism state, oxygen transport, water-electrolyte metabolism, energy state of the patient.

Immunochromatographic rapid diagnosis (ICRD), analysis at the place of medical care, bedside diagnosis. Quantitative and qualitative methods of IED. Performance characteristics of rapid tests. Diagnosis of myocardial infarctions, allergies, infections, etc.

**Section 2. Laboratory studies in the pathology of various organs and systems of the body**

**Theme 3. Complex hematological, hematological analyzers, metrics in reactive and inflammatory conditions (4 hour.).**

The preparation of blood products, the methods of clinical investigation of blood.

The role and place of general clinical studies in diagnostic algorithms of various nosological forms. Changes in hematological parameters in reactive and inflammatory conditions

Blood system research methods: morphological, cytochemical, molecular genetic. Their specificity, sensitivity, diagnostic significance.

The techniques used in the hematological analyzers and flow cytometry technique.

Changes in hematological parameters in reactive and inflammatory conditions.

Diagnostic algorithm of diseases associated with changes in the number and properties of red blood cells, white blood cells and platelets.

Clinical and diagnostic value of the study of hemograms and myelograms in anemia, leukemia, hemorrhagic diathesis and cancer of the blood system.

**Theme 4. Complex koagologic laboratory research. Methods of platelet-vascular hemostasis investigation. Thrombotic conditions. Methods of monitoring of disaggregant therapy (4 hours.)**

Methods of coagulation hemostasis investigation. Indicators of external, internal pathways and stages of coagulation. Methods for determining coagulation factors and differential diagnosis of hemophilia. Methods of evaluation of platelet-vascular hemostasis, types of thromboelastogram and aggregatogram.

Control of disaggregated therapy. Markers of thrombosis, DIC syndrome, antiphospholipid syndrome. The patients with mesenchymal dysplasia. Methods of investigation of anticoagulant hemostasis and fibrinolysis. The criterion of activation of fibrinolysis

**Theme 5. Complex of biochemical studies in liver, kidney and CVS diseases (4 hours).**

Disturbances of the hepatocyte integrity: cytolysis syndrome, increased permeability, hyper-enzyme-emia. Excretory-biliary syndrome: the ratio of enzyme activity and bilirubin fractions. Inflammatory syndrome: total serum



protein and protein fractions, types of proteinograms. Enzymodiagnosics of diseases of the liver. The algorithm of differential diagnosis of jaundice.

Physiological and pathological components of urine, methods of their determination.

Clinical and diagnostic value of urea, creatinine and uric acid. Microalbuminuria and proteinuria.

Evaluation of pancreatic excretory function.

Pancreatitis, the diagnostic value of determining the activity of  $\alpha$ -amylase, lipase, trypsin,  $\alpha$ 1-proteinase inhibitor. Diagnostic criteria for type I and type II diabetes. Hyperglycemia and glucosuria. Effective control of hyperglycemia: determination of glycosylated hemoglobin, fructosamine. indicators

Diagnostic value of determination of cholesterol and its fractions in blood lipoproteins.

Heart attack. The main metabolic disorders in acute myocardial infarction. Cardiospecific proteins. Enzymodiagnosics of myocardial infarction.

**Theme 6. Complex laboratory study of water-electrolyte and mineral metabolism disorders. Acid-alkaline balance of the body and its disorders. (4 hours).**

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

Hyper- and hypopotassiumemia, clinical manifestations. Calcium, hyper- and hypocalcemia in children and adults. Hyper- and hypophosphatemia in children and adults. Methods of determination of mineral exchange indicators. Markers of bone metabolism and osteoporosis.

Clinical and diagnostic value of indicators of the blood acid-base balance. Forms of the acid-base state disorders.

Laboratory diagnostics of critical conditions.

**Theme 7. Comprehensive laboratory study of the immune status in allergic and autoimmune diseases (4 hours.)**

Laboratory evaluation of humoral and cellular immunity, inflammatory mediators and apoptosis. Immune status in immunodeficiency, autoimmune and oncological diseases. Specific diagnostics. Evaluation of the effectiveness of immunocorrective therapy

Principles of laboratory diagnostics of AID, immunological strategies of treatment (correction, prevention) of autoimmune diseases.

**Theme 8. Complex laboratory studies in oncology (DNA-based tumor markers and their clinical significance in the diagnostics and monitoring of pathological processes (4 hours).**

AFP-alpha-fetoprotein as a marker of hepatocellular liver cancer, PSA-prostatic specific antigen as an oncomarker of prostate cancer, CA-125 as a marker of ovarian cancer.

REA — removeability antigen as a tumor marker of colon cancer and other markers, their diagnostic value, patogenetical justification of their dynamics, the clinical significance of laboratory tests.

**Lesson 9. Test. Protect presentations. (4 hours)**

**II. TRAINING AND METHODOLOGICAL SUPPORT INDEPENDENT WORK OF STUDENTS**

Educational and methodological support of independent self-work of students in the discipline "Modern laboratory systems and complexes" is presented in Appendix 1 and includes:

schedule of independent self-work on the discipline, including the approximate standards of time to perform for each task;

characteristics of tasks for independent self-work of students and guidelines for their implementation;

requirements for the presentation and execution of the results of independent work;

criteria for evaluating the execution of independent work.

### III. MONITORING THE ACHIEVEMENT OF THE COURSE OBJECTIVES

No.	Controlled sections / topics of disciplines	Codes and stages of the formation of competencies		Evaluation tools - name	
				Current control	Intermediate certification
1	Section 1. Laboratory systems and complexes in various medical institutions Section 2. Complexes of laboratory studies in the pathology of various organs and systems of the body	the capacity for the assessment of morphological and physiological states and pathological processes in the human body for solving professional tasks (GPC – 9)	Knows	Interview (OA-1)	Questions 1-7
			Able to	Test (PW-1)	Test (PW-1)
			Possesses	Control work (PW-2)	Control work (PW-2)
2	Section 1. Laboratory systems and complexes in various medical institutions Section 2. Complexes of laboratory studies in the pathology of various organs and systems of the body	the readiness to collect and to analyze patient complaints, data of its history, the results of laboratory, instrumental, postmortem and other examinations to recognize the incidence or the absence of diseases (PC – 5)	Knows	Interview (OA-1)	Questions 46-95
			Able to	Test (PW-1)	Test (PW-1)
			Possesses	Control work (PW-2)	Control work (PW-2)
	Section 1. Laboratory systems and complexes in various medical institutions Section 2. Complexes of laboratory studies in the pathology of various organs and systems of the body	the ability of determining the patient's basic pathological conditions, symptoms, syndromes, diseases in accordance with the International Statistical Classification of Diseases and problems related to health, the 10th review.	Knows	Interview (OA-1)	Questions 46-95
			Able to	Test (PW-1)	Test (PW-1)
			Possesses	Control work (PW-2)	Control work (PW-2)

		(PC – 6)			
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Control and methodological materials as well as criteria and indicators necessary for the assessment of knowledge and skills and characterizing the stages of the formation of competencies in the process of mastering the educational program are presented in Appendix 2.

### III. LIST EDUCATIONAL LITERATURE AND INFORMATION SUPPORT OF DISCIPLINE

#### Main literature

1. Advanced Imaging Techniques in Clinical Pathology / Springer Science+Business Media New York 2016  
<https://link.springer.com/book/10.1007/978-1-4939-3469-0#editorsandaffiliations>
2. Immunopathology in Toxicology and Drug Development / Springer International Publishing AG 2017  
<https://link.springer.com/book/10.1007/978-3-319-47385-7#editorsandaffiliations>
3. Molecular Pathology Laboratory Management / Springer, Cham 2016  
[https://link.springer.com/chapter/10.1007/978-3-319-19674-9\\_62](https://link.springer.com/chapter/10.1007/978-3-319-19674-9_62)

#### Additional literature

1. Utilization Management in the Routine Hematology Laboratory / Springer, Cham 2017 [https://link.springer.com/chapter/10.1007/978-3-319-34199-6\\_10](https://link.springer.com/chapter/10.1007/978-3-319-34199-6_10)
2. Laboratory Formularies / Springer, Cham 2017  
[https://link.springer.com/chapter/10.1007/978-3-319-34199-6\\_8](https://link.springer.com/chapter/10.1007/978-3-319-34199-6_8)

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

1. Laboratory information system WHONET 5.0  
([www.who.int/drugresistance/whonetsoftware](http://www.who.int/drugresistance/whonetsoftware)).
2. Association for the development of medical laboratory technologies [Electronic resource]. - Mode of access: <http://www.armit.ru> –

3. Clinical laboratory diagnostics. [Electronic journal.] - Mode of access:  
<http://www.medlit.ru>
4. Russian medical server [Electronic resource]. - Mode of access:  
<http://www.rusmedserv.com>
5. The use of DNA diagnostics in the clinic [Electronic resource]. - Access mode: [http. // www.geneclinics.org](http://www.geneclinics.org)
6. PubMed [Electronic resource]. – Electron. data base. - Mode of access:  
<http://www.ncbi.nlm.nih.gov>
7. HighWire Press [Electronic resource]. – Electron. data base. - Mode of access: <http://www.highwire.stanford.edu>

### III. GUIDELINES FOR DEVELOPMENT OF THE DISCIPLINE

The content of the guidelines includes recommendations for practical classes and laboratory work; description of the sequence of actions and the form of presentation of the results (Appendix 3).

#### LIST OF INFORMATION TECHNOLOGIES AND SOFTWARE

The location of the computer equipment on which the software is installed, the number of jobs	List of licensed software
Multimedia auditorium Vladivostok Russian island, Ayaks 10, building 25.1, RM. M723  Area of 80.3 m2  (Room for independent work)	Windows Seven enterprise SP3x64 Operating System  Microsoft Office Professional Plus 2010  office suite that includes software for working with various types of documents (texts, spreadsheets, databases, etc.);  7Zip 9.20 - free file archiver with a high degree of data compression;  ABBYY FineReader 11 - a program for optical character recognition;  Adobe Acrobat XI Pro 11.0.00 - software package for creating and viewing electronic publications in PDF;  WinDjView 2.0.2 - a program for recognizing and viewing files with the same format DJV and DjVu.

In order to provide special conditions for the education of persons with disabilities all buildings are equipped with ramps, elevators, lifts, specialized places equipped with toilet rooms, information and navigation support signs

### IV. МАТЕРИАЛЬНО-ТЕХНИЧЕСКОЕ ОБЕСПЕЧЕНИЕ

#### ДИСЦИПЛИНЫ

Modern laboratory technologies and complexes	Biochemistry laboratory: dry air Thermostat MIR-262; Scales precision series Pioneer (PA413); laboratory Centrifuge LMC-4200R; Magnetic stirrer MSH-300i with regulators; water Distiller GFL-2008; Stove-top Dream 111Ч; Spectrophotometer with in-nadleznosti for probobably BioSpectrometer-kinetic	690922, Primorsky Krai, Vladivostok, island Russian, the Saperny Peninsula, the village of ayaks, 10, RM. M 432
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	<p>AIO PC HP ProOne 400 G1 AiO 19.5" Intel Core i3-4130T 4GB DDR3-1600 SODIMM (1x4GB)500GB; Screen projection Projecta Elpro Electrol, 300x173 cm; Multimedia projector, Mitsubishi FD630U, 4000 ANSI Lumen 1920 x 1080; Flush interface with automatic retracting cables TLS TAM 201 Stan; Avervision CP355AF; lavalier Microphone system UHF band Sennheiser EW 122 G3 composed of a wireless microphone and receiver; Codec of videoconferencing LifeSizeExpress 220 - Codeconly - Non-AES; Network camera Multipix MP-HD718; Two 47 " LCD panels, Full HD, LG M4716CCBA; audio commutation and sound amplification Subsystem; centralized uninterruptible power supply</p> <p>Medical center of FEFU</p>	<p>Multimedia audience</p> <p>690922, Primorsky Krai, Vladivostok, island Russian, the Saperny Peninsula, the village of ayaks, 10</p>
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**SCHOOL OF BIOMEDICINE**

**TRAINING AND METHODOLOGICAL SUPPORT OF INDEPENDENT  
WORK OF STUDENTS**

**on discipline**

**«Modern Laboratory Technologies and Complexes»**

Education program

Specialty 31.05.01 «General medicine»

**Form of study: full time**

**Vladivostok**

**2018**

## **Recommendations for independent work of students**

Independent self-work (ISW) – consists of preparation for practical classes, work with recommended literature, writing an essay, reports on the topic of the seminar, preparation of presentations, description of laboratory tests with the characteristic of their informativeness for various diseases, the solution of clinical case study tasks by methods of laboratory diagnosis. The work with periodic and fundamental literature, attendance at meetings of the student scientific society, elective courses and scientific conferences, participation in scientific-research work of the department, preparation and execution of the student scientific conferences are an obligatory element of training of the student.

When organizing independent self-work, teacher should take into account the level of training of each student and foresee difficulties that may arise when they would perform independent work. Teacher gives each student individual and differentiated tasks. Some of them can be carried out in a group (for example, the preparation of a report and presentation on one topic can be done by several students with the division of their duties – one prepares the scientific and theoretical part, and the second analyzes the practice).

### **Schedule of independent self-work on discipline**

<b>No.</b>	<b>Date/deadline</b>	<b>Type of independent work</b>	<b>Approximate standards of execution time</b>	<b>Form of control</b>
1	During semester	Preparation to lessons	16 hours	Current knowledge control in classes; credit  (testing, questioning)
2	During semester	Preparation to control works (1, 2)	6 hours	Control work evaluation
3	5-6 <sup>th</sup> week	Essay preparation	20 hours	Essay assessment
4	10 <sup>th</sup> week	Preparation of presentation	12 hours	Presentation assessment

#### **Test evaluation criteria (written response)**

- 100-86 points - if the answer shows deep and systematic knowledge of all program material and structure of the concrete question, and also the main contents and innovations of a lecture course in comparison with educational literature. Student demonstrates a clearness and fluency in concepts and conceptual apparatus, scientific language and terminology of the relevant scientific field, knowledge of the basic literature and advanced familiarity with the recommended literature. Answer is logically correct and convincing presentation.
- 85-76-points – student shows knowledge of the key problems of the program and the main content of the lecture course; ability to use the conceptual apparatus in the analysis of the main problems in the framework of this topic;

knowledge of the most important works from the list of recommended literature. In general, answer is logically correct, but not always with accurate and reasoned statements.

- 75-61 – score – student shows fragmentary, superficial knowledge of the most important sections of the program and the content of the lecture course; difficulties with the use of scientific and conceptual apparatus and terminology of the discipline; incomplete familiarity with the recommended literature; partial difficulties with the implementation of the tasks provided by the program; the desire to logically definite and consistent answer.
- 60-50 points – student shows an absence or fragmentary picture of the problem in the framework of educational program material; the inability to use the conceptual apparatus; the lack of logical connection in response.

#### **Criteria of assessment (verbal response)**

\* 100-85 points - if the answer shows a strong knowledge of the main processes of the studied subject area, different depth and completeness of the topic; possession of the terminological apparatus; the ability to explain the essence of phenomena, processes, events, draw conclusions and generalizations, give reasoned answers, give examples; fluency monological speech, logic and sequence of response; the ability to give examples of modern problems of the study area.

\* 85-76-points – if student gives an answer, which reveals a strong knowledge of the main processes of the studied subject area, characterized by the depth and completeness of the topic; possession of the terminological apparatus; the ability to explain the essence, phenomena, processes, events, draw conclusions and generalizations, give reasoned answers, give examples; fluency of monological speech, logic and sequence of the answer. However, there are one or two inaccuracies in the answer acceptable.

\* 75-61-score – if student gives an estimated answer, indicating mainly the knowledge of the processes of the studied subject area, characterized by

insufficient depth and completeness of the topic; knowledge of the basic questions of the theory; poorly formed skills of analysis of phenomena, processes, insufficient ability to give reasoned answers and give examples; not enough free possession of monological speech, logic and sequence of the answer. There are several mistakes in the content of the answer; inability to give an example of the situation, to communicate with other aspects of the study area.

\* 60-50 points – if student gives an answer revealing ignorance of processes of the studied subject area, differing in superficial disclosure of a subject; ignorance of the main questions of the theory, the unformed skills of the analysis of the phenomena, processes; inability to give the reasoned answers, weak possession of monologic speech, lack of logic and sequence. Serious errors in the content of the answer are allowed; ignorance of modern problems of the studied area.

### **Methodical instructions to their essay implementation**

#### **Goals and objectives of an essay**

Essay is a summary of problem of practical or theoretical origin with the formulation of certain conclusions on the topic under consideration. The problem chosen by the student is studied and analyzed on the basis of one or several sources. In contrast to the course work, which is a comprehensive study of the problem, the essay is aimed at the analysis of one or more scientific papers.

The purposes of writing the essay are:

- development of students ' skills in search of actual problems of modern legislation;
- development of skills of summarizing material with the allocation of only the most essential points necessary for the disclosure of the essence of the problem;
- development of skills of the analysis of the studied material and formulation of own conclusions on the chosen question in writing, scientific, competent language.

The objectives of an abstract writing are:

- to teach student to convey the opinions of the authors as correctly as possible, on the basis of which the student writes his / her essay;
- to teach students to competently express their attitude on the problem analyzed in an essay;
- to prepare students for further participation in scientific conferences, seminars and competitions;
- to help the student to determine the topic of interest for him/her, further disclosure of which is possible to carry out when writing a term paper or diploma;
- to understand and explain the reasons for their consent (disagreement) with the opinion of an author on this issue.

### **Basic requirements for the content of essay**

Student should use only those materials (scientific articles, monographs, manuals) that are directly related to the chosen topic. Detached arguments not related to the analyzed problem are not allowed. The content of an essay should be specific, only one problem should be investigated (several are allowed only if they are interconnected). Student must strictly adhere to the logic of presentation (start with the definition and analysis of concepts, go to the formulation of the problem, to analyze the ways of its solution and draw the appropriate conclusions). The essay should end with conclusions on the topic.

The structure of an essay consists of:

1. Title page;
2. Introductions where the student formulates a problem to be analyzed and investigated;
3. The main text, which consistently reveals the chosen theme. In contrast to the course work, the main text of the abstract is divided into 2-3 paragraphs without highlighting the chapters. If necessary, the text of the abstract can be supplemented with illustrations, tables, graphs, but they should not "overload" the text;

4. Conclusions, where student formulates conclusions based on the main text.

5. List of references. In this list are called as the sources referred to by the student in the preparation of the essay, and others that have been studied by him in the preparation of the essay

The volume of essay is 10-15 pages of typewritten text, but in any case should not exceed 15 pages. Interval – 1.5, font size – 14, margins: left — 3cm, right — 1.5 cm, top and bottom — 1.5 cm. Pages should be numbered. Paragraph indent from the beginning of the line is 1.25 cm.

### **Order of essay submission and its evaluation**

Essay is written by students during the trimester in the terms established by the teacher, and is given to the teacher, leading the discipline (the deadline for submission of the essay is determined by the teacher).

According to the results of the test, student is given a certain number of points, which is included in the total number of points the student scored during the trimester. The assessment of the essay takes into account the correspondence of the content of the selected topic, clarity of the structure of the work, the ability to work with scientific literature, the ability to pose a problem and analyze it, the ability to think logically, proficiency in professional terminology, literacy design.

#### **Approximate themes of essays**

1. Algorithm of the jaundice laboratory diagnostics
2. Anemic syndrome
3. DIC. Diagnostic method
4. Diagnostics of acidosis and alkalosis
5. Clinical and diagnostic value of hemograms and myelograms

6. Control of treatment with indirect anticoagulants
7. Laboratory diagnostics of emergency conditions
8. Laboratory criteria for the effectiveness of anemia treatment
9. Laboratory control of antithrombotic therapy
10. Markers of acute and chronic inflammation
11. Markers of fibrosis. Antifibrotic drugs
12. Medical laboratory diagnostics of atherosclerosis
13. Medical laboratory diagnostics of acute pancreatitis
14. Metabolic syndrome
15. Molecular diagnosis of thrombophilia
16. Tumor markers.
17. Organization of quality control of laboratory tests.
18. Organization of specialized clinical diagnostic laboratories.
19. Basics of early diagnostics of malignant tumors.
20. Flow cytometry. Application
21. Syndrome of renal eclampsia: laboratory diagnostic methods
22. Modern concepts of myelodysplastic syndrome

### **EVALUATION CRITERIA FOR ESSAYS:**

#### **Criteria for evaluation of written essay and oral presentation:**

100-86 points - are designated to student if student expressed the opinion on the formulated problem, reasoned it, having precisely defined its contents and components. The data of domestic and foreign literature, statistical information, regulatory information. The student knows and has the skill of independent research on the topic of study; methods and techniques of analysis of theoretical and / or practical aspects of the study area. There are no actual errors related to understanding the problem; the work is graphically designed correctly

#### **Grade: excellent**

85-76 – points - the work is characterized by semantic integrity, coherence and sequence of presentation; no more than 1 mistake in explaining the meaning or content of the problem. The data of domestic and foreign authors are given for



argumentation. Research skills are demonstrated. There are no actual errors related to understanding the problem. Made one or two mistakes in the design of the work

Grade: **good**

75-61 point - student conducts a fairly independent analysis of the main stages and semantic components of the problem; understands the basic foundations and theoretical basis of the chosen topic. The main sources on the topic are involved. No more than 2 mistakes were made in the sense or content of the problem, the design of the work

Grade: **satisfactory**

60-50 points-if the work is a retold or completely rewritten source text without any comments, analysis. The structure and theoretical component of the topic is not disclosed. Allowed three or more three errors in the semantic content of the problem, in the design of the work

Grade: **fail**



MINISTRY OF EDUCATION AND SCIENCE OF THE RUSSIAN FEDERATION  
Federal state autonomous educational institution  
of higher education  
**« Far Eastern Federal University »**  
(FEFU)

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**SCHOOL OF BIOMEDICINE**

**ASSESSMENT FUND**  
«Modern Laboratory Technologies and Complexes»  
Education program  
Specialty 31.05.01 «General medicine»  
Form of study: full time

**Vladivostok**

**2018**

## Passport of assessment fund

Filled in in accordance with the Regulations on the funds of evaluation means of educational programs of higher education – undergraduate programs, specialty, master's degree FEFU, approved by order of the rector of 12.05.2015 №12-13-850.

Competence and its code	Stages of competence formation	
- the capacity for the assessment of morphological and physiological states and pathological processes in the human body for solving professional tasks (GPC – 9)	Knows	The structure and functioning of the human body in the normal and pathology, identified by laboratory diagnostics.
	Able to	Using the methods of laboratory diagnostics to determine the structure and function of human organs in normal and pathological conditions.
	Masters	The basics of determining the structure and function of human organs in the norm and pathology, identified by methods of laboratory diagnosis.
the readiness to collect and to analyze patient complaints, data of its history, the results of laboratory, instrumental, postmortem and other examinations to recognize the incidence or the absence of diseases (PC – 5)	Knows	Modern methods of clinical, laboratory, instrumental examination of patients, their diagnostic capabilities;
	Able to	justify the need for clinical and laboratory examination of the patient identify and analyze clinically relevant information obtained in the laboratory examination of patients; morphological analysis of biopsy, surgical and sectional material
	Masters	Skills for interpretation of the results of laboratory studies, morphological descriptions of biopsy, operational and sectional material Skills for competent registration of the medical history in the section of appointment of laboratory examination and interpretation of its results.
the ability of determining the patient's basic pathological conditions, symptoms, syndromes, diseases in accordance with the International Statistical Classification of Diseases and problems related to health, the 10th review. (PC – 6)	Knows	pathophysiological characteristics of the main clinical syndromes and their parameters described by the results of laboratory studies
	Able to	to substantiate pathogenetically justified methods (principles) of diagnostics among adults and adolescents, taking into account their age and gender groups
	Masters	- interpretation of the results of laboratory methods of diagnostics - technique of biological material collection for laboratory studies in children, adolescents and adults; - methods of assessing the effectiveness of therapy on the results of laboratory monitoring of informative parameters
	Masters	- to diagnose diseases and pathological processes taking into account the results of clinical and

		immunological examination - methods of bedside diagnosis (glucose determination, the use of urinary strips, allergodiagnosics) using " dry chemistry»
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Competence and its code		Stages of competence formation			
No.	Controlled sections / topics of disciplines	Codes and stages of the formation of competencies		Evaluation tools - name	
				Current control	Intermediate certification
1	Section 1. Laboratory systems and complexes in various medical institutions Section 2. Complexes of laboratory studies in the pathology of various organs and systems of the body	- the capacity for the assessment of morphological and physiological states and pathological processes in the human body for solving professional tasks (GPC – 9)	Knows	Interview (OA-1)	Questions 1-7
			Able to	Test (PW-1)	Test (PW-1)
			Owns	Control work (PW-2)	Control work (PW-2)
2	Section 1. Laboratory systems and complexes in various medical institutions Section 2. Complexes of laboratory studies in the pathology of various organs and systems of the body	the readiness to collect and to analyze patient complaints, data of its history, the results of laboratory, the ability of determining the patient's basic pathological conditions , symptoms, syndromes, diseases in accordance with the International Statistical Classification of Diseases and problems related to health , the 10th review. (PC – 6)	Knows	Interview (OA-1)	Questions 46-95
			Able to	Test (PW-1)	Test (PW-1)
			Own	Control work (PW-2)	Control work (PW-2)
	Section 1. Laboratory systems and complexes in various medical institutions Section 2. Complexes of laboratory studies in the pathology of various organs and systems of the body	the ability of determining the patient's basic pathological conditions , symptoms, syndromes, diseases in accordance with the International Statistical Classification of Diseases and problems related to health , the 10th review. (PC – 6)	Knows	Interview (OA-1)	Questions 46-95
			Able to	Test (PW-1)	Test (PW-1)
			Own	Control work (PW-2)	Control work (PW-2)

Competence and its code	Stages of competence formation	criteria	parameters	points
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the readiness to collect and to analyze patient complaints, data of its history, the results of laboratory, instrumental, postmortem and other examinations to recognize the incidence or the absence of diseases (PC – 5)	Knows	Modern methods of clinical, laboratory, instrumental examination of patients, their diagnostic capabilities;	Answers to questions	Oral survey, control work	61-75
	Able to	justify the need for clinical and laboratory examination of the patient identify and analyze clinically relevant information obtained in the laboratory examination of patients; morphological analysis of biopsy, surgical and sectional material -	Use of the acquired knowledge in practice	Problem solving, practical work	76-85
	Masters	Skills of interpretation of the laboratory research results, morphological descriptions of biopsy, operational and sectional material Skills of competent registration of the medical history in the part of appointment of laboratory examination and interpretation of its results.	Practical skills	Practical work	86-100
the ability of determining the patient's basic pathological conditions, symptoms, syndromes, diseases in accordance with the International Statistical Classification of Diseases and problems related to health, the 10 <sup>th</sup> review. (PC – 6)	Knows	pathophysiological characteristics of the main clinical syndromes and their parameters described by the results of laboratory studies	Answers to questions	Oral survey, control work	61-75
	Able to	substantiate pathogenetically justified methods (principles) of diagnostics among adults and adolescents, taking into account their age and sex groups	Use of the acquired knowledge in practice	Problem solving, practical work	76-85
	Masters	- interpretation of the results of laboratory methods of diagnosis - technique of collection of biological material for laboratory studies in children, adolescents and adults; - methods of assessing the effectiveness of therapy on the results of laboratory monitoring of informative parameters	Practical skills	Practical work	86-100

- the capacity for the assessment of morphological and physiological states and pathological processes in the human body for solving professional tasks (GPC – 9)	Knows	The structure and functioning of the human body in the normal and pathology, identified by laboratory diagnostics.	Knowledge of the features of the structure and functioning of the human body in the normal and pathology, identified by methods of laboratory diagnosis.	Formed knowledge of the features of the structure and functioning of the human body in the normal and pathology, identified by methods of laboratory diagnosis.	61-75
	Able to	Using the methods of laboratory diagnostics to determine the structure and function of human organs in normal and pathological conditions.	The ability to determine the structure and function of human organs in normal and pathological conditions using the methods of laboratory diagnostics.	Willing and able with the help of methods of laboratory diagnosis to determine the structure and function of the organs of the human body in health and disease .	76-85
	Masters	The basics of determining the structure and function of human organs in the norm and pathology, identified by methods of laboratory diagnosis.	Skills define the structure and functions of the organs of the human body in health and disease, identify methods of laboratory diagnostics.	The ability to determine the structure and function of human organs in normal and pathological conditions, identified by laboratory diagnostics.	86-100

### **Guidelines defining the procedures of evaluation of learning outcomes of the discipline**

**Current certification of students.** Current certification of students in the discipline "Modern laboratory systems and complexes" is carried out in accordance with local regulations FEFU and is mandatory.

Current certification in the discipline "Modern laboratory systems and complexes " is carried out in the form of control measures (defense of the practical

work, control work, essay, testing) to assess the actual results of training of students and is carried out by a leading teacher.

The objects of evaluation are:

- academic discipline (activity in the classroom, the timeliness of various types of tasks, attendance of all types of classes on the certified discipline);
- the degree of assimilation of theoretical knowledge;
- level of mastering practical skills in all types of educational work;
- the results of independent self-work.

**Interim certification of students.** Interim certification of students in the discipline "Modern laboratory systems and complexes" is carried out in accordance with the local regulations of FEFU and is mandatory.

The discipline provides for credit conducted in written form with the use of testing.

The number of points sufficient to obtain a credit: 61 (40 correct answers out of 65 possible).

### **Sample questions for the test and exam:**

1. Stages of clinical and laboratory research: content and general characteristics
2. General concept of the norm and the desired oscillation intervals of the analyte values. Causes of deviations from normal laboratory results: non-pathological and pathological variability of factors.
3. Diagnostic evaluation of blood protein contents. Hypoproteinemia (absolute and relative): causes, mechanisms, diagnostic value. Hyperproteinemia (absolute and relative): causes, mechanisms, diagnostic value.
4. C-reactive protein, functional characteristics and clinical diagnostic value.
5. Laboratory markers of myocardial damage: traditional program (AST, LDH, KK-total activity, KK-MV-activity, myoglobin), characteristics of informative laboratory tests.

6. Cardioselective markers as the basis of the modern laboratory program for detection of myocardial destruction: troponins I & T. determination of QA-M (mass): the essence of the method, analytical characteristics.
7. Characteristics and clinical and diagnostic value of traditional (serum iron, TIBS) and modern (soluble transferrin receptor, transferrin, ferritin) laboratory methods for assessing the state of iron metabolism.
8. Laboratory syndromes in liver pathology. Characteristics and mechanisms of manifestations of cytolysis and cholestasis syndromes. The expressed mesenchymal-inflammatory syndrome of hepatodepressive: morphological basis and basic laboratory parameters.
9. Evaluation of pancreatic function. Determination of the activity of  $\alpha$  - amylase, lipase, trypsin.
- 10.1 Biochemical diagnosis of pathology of the cardiovascular system. Determination of lipid metabolism: total lipids, cholesterol, triacylglycerols,  $\beta$ -lipoprotein.
11. Enzymodiagnosics of the heart diseases. Determination of creatine phosphokinase activity, lactate dehydrogenase, rapid tests for troponin and other markers of heart muscle damage,
12. Regulation of hematopoiesis: participants of the process (colony stimulating factors, cytokines, apoptosis, transcription factors, etc.) and their characteristics.
13. Morphology of erythroid cells. Characteristics of morphological changes occurring as the differentiation of erythroid cells. Types of hematopoiesis (normoblastic, megaloblastic): their characteristics and main differences.
14. Laboratory evaluation of the red blood cell destruction. Erythrodiuresis and hemolysis, their mechanisms. Abnormalities of erythrocyte morphology: pathology of shape, size and their clinical significance.
15. Morphology of leukocytes, their classification. Morphological and functional characteristics of the cellular elements of the granulocytogenesis (identification signs of the cells).



16. Morphological and functional characteristics of cell elements of monocytopoiesis and lymphocytopoiesis (identification signs of cells). Characteristics of neutrophilic leukocyte granules: substances contained in them, their role in the mechanisms of bactericidal action of neutrophils.
17. Abnormal morphology of white blood cells: characteristics and clinical-diagnostic value.
18. Basic erythrocyte parameters of automated blood analysis. Pathological forms of red blood cells. Pathological forms of leukocytes.
19. Determination of APTT, PT, TT, and fibrinogen
20. Determination of cellular immunity parameters in immunodeficiency, allergic and autoimmune conditions.
21. Sensitivity and specificity of tests. Definition and meaning. Reliability and accuracy of the results. Definition and meaning.
22. List the rules of blood collection for biochemical studies.
23. Physiological variability of results, pharmacological and therapeutic agents affecting the results of studies.
24. Changes related to violation of the rules for obtaining and storing samples.
25. Enzymes and isoenzymes. The value of research.
26. Classification of enzymes Determination of catalytic activity of enzymes.
27. Lactate dehydrogenase, its isoenzymes and the meaning of determination.
28. Alanine aminotransferase, the value of determination.
29. Aspartate aminotransferase, definition value.
30. Glutamate dehydrogenase, the value of determination.
31. Glutamyl transpeptidase, the value of determination.
32. Creatine kinase, its isoenzymes and the meaning of the definition.
33. Phosphatase, types and value definitions.
34. Cholinesterase, meaning of definition.
35. Amylase and lipase, meaning definition.
36. Indicators of water-salt metabolism, regulation and diagnostic value of the definition. Conditions characterized by increased and decreased levels of K

- in blood. Conditions characterized by increased and decreased levels of Na in blood.
37. Conditions characterized by an increase and decrease in the level of Ca in blood. Conditions characterized by increased and decreased levels of Mg in blood. Conditions characterized by increased and decreased Cl levels in blood.
  38. Conditions characterized by changes in the level of trace elements in blood.
  39. Acid-base balance. Buffer systems, their characteristics. Alkalosis, definition, classification. Acidosis, definition, classification.
  40. The importance of research for the early diagnosis of metabolic diseases.
  41. Study of endocrine functions, methods and interpretation of laboratory data.
  42. Laboratory tests for cardiovascular pathology and diagnostic value.
  43. Laboratory tests that determine the state of the respiratory system.
  44. Indicators of hepatocellular damage.
  45. Parameters indicating liver dysfunction.
  46. Evaluation of the functional state of the liver according to the blood biochemical study. Laboratory indicators of cholestasis.
  47. Study of kidney function. Indicators of blood and urine in various pathologies of the kidneys.
  48. Indicators that determine allergic reactions, research methods and interpretation of the results.
  49. Indicators that determine autoimmune disorders, research methods and interpretation of the results.
  50. Diagnosis of mineral metabolism disorders in the industrial complex.
  51. Diagnosis of subclinical and clinical keto-acidosis.

**The criteria for issuing an assessment to the student on the credit/ the exam on the discipline "Modern laboratory systems and complexes»:**

<b>Points</b> (rating grade)	<b>Assessment credit/ exam</b> (standard)	<b>Requirements to the formed competences</b>
85-100	<i>credit/</i> <i>«excellent»</i>	"Excellent" is assigned to the student if it is deeply and firmly grasped the knowledge of laboratory systems and complexes exhaustively, consistently, clearly and logically it presents a coherent, able to closely link theory with practice, copes with the tasks, questions and other applications of knowledge, and is not difficult to answer when modifying tasks, uses the material in the answer monographic literature, properly substantiates the decision, possesses the skills and techniques of implementation of practical tasks.
76-85	<i>credit/</i> <i>«good»</i>	Grade "good" is given to a student, if he/she knows the material, competently and essentially sets it, without allowing significant inaccuracies in the answer to the question, correctly applies the theoretical provisions in solving practical issues and problems, has the necessary skills and techniques of their implementation.
61-75	<i>«credit»/</i> <i>«satisfactory»</i>	Grade "satisfactory" is given to a student if he/she has knowledge only of the basic material, but did not learn its details, admits inaccuracies, insufficiently correct formulations, violations of logical sequence in the statement of program material, has difficulties at performance of practical works.
< 61	<i>«failed»</i>	Grade "failed" is given to a student who knows significant parts of the program material, allows substantial errors, uncertain, with great difficulty tasks performed at the "unsatisfactory" tests, have not coped with the implementation of scientific research (essay).

## **Evaluation tools for current certification**

### **Test tasks**

#### **Section 1. ORGANIZATION OF THE LABORATORY SERVICE**

##### **1. QUALITY CONTROL IS**

- 1) Employee performance review
- 2) Comparison of research results
- 3). a system of measures to quantify the correctness of laboratory research, active and systematic identification and minimization of errors for which the laboratory is responsible
- 4). quantitative evaluation of the accuracy

5). all of the above

2. The main types of clinical diagnostic laboratories (CDL) of health care facilities include all but:

- 1) general type
- 2) centralized
- 3) specialized
- 4) semi-centralized

3. The results of the analysis can be affected by factors in addition to:

- 1) physical and emotional state
- 2) circadian rhythms
- 3) body positions
- 4) social status of the patient

4. The accompanying form of the sample getting the lab should bear all listed, except:

- 1) patient's name
- 2) list of indicators
- 3) surnames of the attending physician
- 4) research methods

5. Venous blood from the patient should be taken:

- 1) after meals
- 2) on an empty stomach
- 3) after physiotherapy
- 4) after taking medications

6. A study that does not require 12-hour abstinence from eating:

- 1) determination of cholesterol
- 2) analysis of total protein
- 3) general blood test
- 4) glucose measuring

7. To control the correctness of the studies it is recommended to use:

- 1) aqueous solution of substrates

- 2) reference serum
- 3) donor blood
- 4) distilled water

8. In-laboratory quality control covers all stages of laboratory studies, except:

- 1) preanalytic
- 2) analytical
- 3) non-analytical
- 4) post-analytical

9. The coefficient of variation is used to estimate:

- 1) reproducibility
- 2) sensitivity
- 3) correctness
- 4) specificity

10. The main meaning of control cards is:

- 1) identifying acceptable analytical errors
- 2) assessing correctness of the method
- 3) in the evaluation of the reproducibility method
- 4) in the evaluation of the sensitivity method

11. External quality control enables:

- 1) compare the performance of several laboratories
- 2) assess the sensitivity of the methods used
- 3) standardize research methods and conditions
- 4) certified reference materials

12. The way to detect analytical errors is:

- 1) continuous quality control
- 2) choice of analytical method
- 3) sequential registration of analyses
- 4) communication of the laboratory with the attending physician

### Evaluation criteria:

86-100 points are given to a student, if he/she made no more than 5% of errors in the test task, correctly solved and designed the problem.

76-85 points are given to a student, if he/she made 6-12% of errors in the test task, the problems are solved correctly, minor errors are allowed in the course of solving and in the design of tasks.

75-61 points are given to a student, if he/she made no more than 13 - 20% of errors in the test task, correctly solved at least 1 problem, minor errors are allowed in the course of solving and in the design of tasks.

60-50 points are given to a student if he made more than 20% of mistakes in the test task and/or did not solve any problem correctly.

### TASK № 2

58-year-old man with history of alcohol abuse, taken to the hospital with complaints of vomiting of dark blood. The state of moderate severity, pulse 100 beat/min, blood pressure 100/60 mm. hg. Examination: icteric and wet skin, traces of blood on clothes. The abdomen is soft, moderately painful in epigastrium, liver enlargement (+2 cm) and spleen.

The following laboratory tests were performed in the reception room: bilirubin - 70  $\mu\text{mol/l}$ , ALT - 168 U/l, AST - 185 U/l, prothrombin by Kvik - 43%, INR - 2.1, fibrinogen - 1.4 g/l.

Your preliminary diagnosis. Make a plan for the laboratory examination. Evaluate the results.

### COMMENT!

The patient suffers from liver cirrhosis, complicated by bleeding from varicose veins of the esophagus with the background of alcohol abuse.

The plan of laboratory examination: clinical blood test (anemia degree), biochemical analysis characterizing the state of liver function, coagulogram with the study of screening tests and prothrombin complex factors.

### BIOCHEMICAL ANALYSIS

Parameter	Value.	Meas. unit	Norm	Parameter	Value	Meas. unit.	Reference value
Total protein	<b>55</b>	g/L	65-85	ALT	<b>168</b>	U/L	M under 40

Protein fractions (γ-glob.)	<b>25</b>	g/L					F under 31
Albumin	<b>28</b>	g/L	35-55	AST	<b>185</b>	U/L	M under 37
Total bilirubin	<b>70</b>	Mcmol/L	8,5-20,5				F -under 31
Direct bilirubin		Mcmol/L		γ-GTP	<b>124</b>	U/L	M 11-50
Indirect bilirubin		Mcmol/L					F 7-32

An increased bilirubin, hypoalbuminemia, hypergammaglobulinemia, an increased level of transaminases indicates changes in liver function.

### *Coagulogram*

Indicator, unit of measurement	Result	Norm plasma	reference interval
Platelet number * 10 <sup>9</sup> /L	<b>120</b>		175 – 400
Blood coagulation time (min.)	<b>16</b>		5 – 12
APTT (sec.)	<b>72</b>	36	Normal plasma ± 5
International normalized ratio (INR)	<b>2,1</b>		0,8 – 1,2
Prothrombin on Quick (%)	<b>43</b>		93 – 107
Thrombin time (sec.)	<b>27</b>	15	Норм.плазма ± 3
Fibrinogen (g/l)	<b>1,4</b>		2 – 4
D-dimer (mcg/ml)	<b>0,22</b>		0-0,5

The results of screening tests revealed a slight thrombocytopenia and clotting disorder with an increase in activated partial thromboplastin, prothrombin and thrombin time.

It is necessary to determine the activity of coagulation factors: II, V, VII, X.

factor II	factor V	factor X	Factor VII
<b>35%</b>	<b>32%</b>	<b>28%</b>	<b>25%</b>

The lack of these factors is typical for liver cirrhosis and depends on the degree of damage to liver cells. Thrombocytopenia is secondary due to hypersplenism (deposition and increased destruction of platelets in the spleen). An increase in thrombin time at normal fibrinogen concentration may be associated with dysfibrinogenemia, which is often found in liver dysfunction, hypergammaglobulinemia, and the effect of these disorders on fibrin polymerization. The increase in the content of D-dimer indicates the development of intravascular coagulation. Disorders aggravating the bleeding.

**Task № 3.**

1. Evaluate the results of the urine analysis by zimnitskiy.
2. General rules of urine collection in the study.
3. Disposal of biomaterial and disinfection of laboratory equipment.
4. Determine the pathology, which is characterized by these changes.
5. Specify the possible causes that contributed to the development of this pathology and clinical manifestations of this disease.

<b>ZIMNITSKIY ANALYSIS OF URINE № 3</b>					
«9» october 2011r. Department of urology					
Patient name D-- I. V.					
Time	Unrine volume, ml	Relative density	Time	Unrine volume, ml	Relative density
6-9 h	150	1,007	18-21h	185	1,007
9-12 h	125	1,018	21-24 h	170	1,008
12-15 h	180	1,007	0-3 h	110	1,008
15-18 h	105	1,009	3-6 h	90	1,009

The volume of liquids consumed within day was 2l.

**Task № 4.**



When determining the amount of protein in the urine by the method of Brandberg – Roberts - Stolnikov, a threadlike ring appeared immediately after the layering of whole urine, and after the re-layering of the urine diluted in the appropriate number of times, a threadlike ring appeared after 3 minutes.

- 1.Organic renal proteinuria.
- 2.Calculate the amount of protein in the urine.
3. Disposal of biomaterial and disinfection of laboratory equipment.
- 4.Determine the pathology, which is characterized by these changes.
- 5.Specify the possible causes that contributed to the development of this pathology and clinical manifestations of this disease

### **Task №5**

The 26-year-old patient was admitted into the clinic with complaints of severe weakness, shortness of breath, headache, nausea, frequent nosebleeds. At the age of 19 she suffered acute glomerulonephritis. After that, there were headaches, pasty face, moderate proteinuria.

On admission: skin dry, pale with a yellowish tinge, no swelling, blood pressure 160/100 mm Hg.

Results of the general analysis of urine revealed:

<b>URINE ANALYSIS № 5</b>	
<b>Patient name</b>	Sokolova N.I.
Quantity -2,2 l in a day	Reaction - pH -5,5
Color pale yellow	Relative density -1,010
Protein - 5 g/l	Urobilin -
Glucose -	
Leukocytes - 2-3 в п/зр.	
Red blood cells - single in vision field.	
Cylinders, hyaline – singles in preparation	
Epithelium flat - a small amount	
Epithelium transitional -	

Renal epytheliun - 1-2 in vision field.	
Slime -	Bacteria -
Salts-oxalates in a small amount	

1. Evaluate the result of the urine test.
2. Functional renal proteinuria.
3. Disposal of biomaterial and disinfection of laboratory equipment.
4. Determine the pathology, which is characterized by these changes.
5. Specify the possible causes that contributed to the development of this pathology and clinical manifestations of this disease.
  - A. pyelonephritis
  - B. chronic glomerulonephritis
  - C kidney tuberculosis
  - D. cystitis.

### **Criteria for the grading of the decision of situational tasks**

**Complete solution** - the solution of the problem with the correct answer; incomplete solution – the course of the solution is correct, but the end result is incorrect; there is no solution-there is no solution or the course of the solution is chosen incorrectly, the presence of gross errors.

**Excellent** - at least four questions (out of five) have complete solutions and one has an incomplete solution. The content of the answers testifies to the confident knowledge of the student and his ability to solve professional problems corresponding to his future qualification.

**Good - a minimum of four questions have complete solutions;**

Options:

- at least three questions have complete solutions and two questions have incomplete solutions;
- at least three questions have full solutions, one question has an incomplete solution and in one question the correct solution is begun, but it is not brought to the end. The content of the answers testifies to the sufficient knowledge of the student and his ability to solve professional problems corresponding to his future qualification.

**Satisfactory – a minimum of three questions have full solutions;**

Options:

- at least two questions have complete solutions and two questions have incomplete solutions, one question has no solution;
- at least two issues have complete solutions, one issue has an incomplete solution, one issue started the correct solution, but not brought to an end, one issue has no solution. The content of the answers indicates the lack of knowledge of the graduate and his limited ability to solve professional problems.

**Unsatisfactory** - three issues (out of five) have no solution. The content of the answers testifies to the weak knowledge of the graduate and his/her inability to solve professional problems.