



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)**

«Microbiology, Virology»

Education program

Specialty 31.05.01 «General medicine»

**Form of study: full time**

year 2,3, semester 4,5  
lectures 36 hours  
practical classes 72 hours  
laboratory works 36 hours  
total amount of in-classroom works 162 hours  
independent self-work 144 hours  
including exam preparation 54 hours  
control works ()  
credit year 2, semester 4  
exam year 3, semester 5

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: prof. Zaytceva E.A.

## ABSTRACT

**Bachelor's/Specialist's/Master's degree in General Medicine, 31.05.01**

**Study profile/ Specialization/**

**Course title:** *Microbiology, virology*

**Basic (variable) part of Block 1, 7 credits**

**Instructor:** *Zaitseva E.A.*

**At the beginning of the course a student should be able to:**

- use in practice methods of Humanities, natural Sciences, biomedical Sciences in training activities;
- reveal natural essence of problems, analyze the results of natural-scientific, medical-biological, to improve their professional knowledge and skills;
- do the research by using a systematic approach, to accept innovations, to use the acquired theoretical and methodological knowledge and skills in natural Sciences, medico-biological disciplines in the classroom and have the following competences:

**Learning outcomes:**

PC- 3	ability and readiness for anti-epidemic measures, organization of protection of the population in the centers of especially dangerous infections, with deterioration of the radiation situation, natural disasters and other emergency situations
PC- 16	willingness to educate on the elimination of risk factors and the formation of skills for a healthy lifestyle

Note: PC = professional competences

**Course description:** The course “Microbiology, virology” covers modern problems of general microbiology, private microbiology, clinical microbiology, sanitary microbiology. Common microbiology include the history of the subject, the general courses of bacteriology, virology, the doctrine of infection, including chemotherapy, ecology of microorganisms. Private microbiology course includes the study of individual nosologic forms of infectious diseases, their etiology, path-

ogenesis, epidemiology, clinical, prevention (bacteriology, virology, mycology, protozoology).

**Main course literature:**

1. Jawetz Melnick & Adelbergs Medical Microbiology 26 E (Lange) 26th Edition. Textbook. Karen C. Carroll, Janet S. Butel, Stephen A. Morse., 2013, 877 pages.
2. Prescott Harley Klein's Microbiology 7th Edition. Textbook. Joanne Willey, Linda Sherwood, Chris Woolverton., 2007, 1088 pages.
3. Review of Medical Microbiology and Immunology (Lange Medical Books) 13th Edition. Textbook. Warren Levinson., 2014, 800 pages.

**Forms of final control:** *exam/offset (pass-fail exam).*

## **Annotation to the work program of the discipline**

### **«Microbiology, virology»**

The discipline "Microbiology, Virology" is intended for students enrolled in the educational program 05/31/01 - General Medicine is included in the basic part of the curriculum. Discipline is implemented in 2-3 courses in 4-5 semesters.

In developing of the work program of the discipline, the Federal State Educational Standard of Higher Education in the specialty 31.05.01 General Medicine, the curriculum for training specialists in the specialty 31.05.01 General Medicine, were used.

The total complexity of the discipline is 7 test units, 252 hours. The curriculum provides lectures (36 hours), laboratory classes (36 hours), practical classes (72 hours), independent work of students (54 hours).

Students form a conscious understanding of the relationship between microorganisms and human health, the importance of the environment and the micro world in the development of diseases, which is a necessary prerequisite for studying such disciplines as therapy, surgery, infectious diseases. Students take an active part in carrying out scientifically grounded and effective therapeutic measures, preventing diseases, and promoting a healthy lifestyle.

A special feature in the construction and content of the course is the use of active learning methods, software and hardware, a fund of methodological, evaluation and electronic means of discipline maintenance.

The content of the discipline covers contemporary issues of general microbiology, clinical microbiology, sanitary microbiology. The general part of microbiology is presented by the history of the subject, general courses of bacteriology, virology, concept of inflectional process, including chemotherapy, the ecology of microorganisms. The private course of microbiology includes the study of individual nosological forms of infectious diseases: etiology, pathogenesis, epidemiology, clinical presentation, and prevention (course of bacteriology, virology, mycology, protozoology).

The discipline “Microbiology, virology” is logically and meaningfully connected with such courses as general and inorganic chemistry, organic chemistry, analytical chemistry, biology, botany, physiology with the basics of anatomy, pathology.

**The purpose** of studying the discipline of microbiology, virology is the formation of medical thinking among students, based, inter alia, on the knowledge of the biological properties of microorganisms and their role in the development of diseases and the formation of immunity; the use of modern methods of diagnosing infectious diseases, biological preparations for the specific prophylaxis and treatment of infectious human diseases.

**Tasks** of microbiology, virology as a profile educational discipline:

1. Obtaining of theoretical knowledge in the field of systematics and nomenclature of microorganisms, their morphology, physiology, identification, role in nature, in infectious and non-infectious human pathology.

2. Obtaining knowledge on the mechanisms of interaction of microbes with the human body, the pathogenesis of infectious diseases; methods of microbiological diagnostics, principles of etiotropic treatment and specific prophylaxis of diseases, use of basic antibacterial, antiviral and biological preparations.

3. Formation of a systematic approach to the analysis of scientific medical information, including the identification of aerobic and anaerobic microorganisms from the studied material, based on micro preparations of biological objects and knowledge of the biological properties of pathogens.

As a result of studying this discipline, students form the following general cultural and professional competencies (elements of competencies).

- ability and readiness to conduct anti-epidemic measures, organization of protection of the population in the centers of especially dangerous infections, with deterioration of the radiation situation, natural disasters and other emergency situations (PC-3);

- willingness to educate on the elimination of risk factors and the formation of skills for a healthy lifestyle (PC-16).

Code of competence	Stages of competence formation	
<p style="text-align: center;"><b>PC-3</b></p> <p>- ability and readiness for anti-epidemic measures, organization of protection of the population in the centers of especially dangerous infections, with deterioration of the radiation situation, natural disasters and other emergency situations.</p>	Knows	Types of anti-epidemic measures, techniques and methods of protecting the population in the outbreaks of especially dangerous infections with a deterioration of the radiation situation and other emergency situations.
	Knows how	to assess the degree of danger in the development of anti-epidemic measures, techniques and methods of protecting the population in the outbreaks of especially dangerous infections with a deterioration of the radiation situation and other emergency situations to solve professional problems.
	Has the skill	Organizational skills in the areas of particularly dangerous infections, with deterioration of the radiation situation, natural disasters and other emergency situations.
<p style="text-align: center;"><b>PC-16</b></p> <p>- willingness to educate on eliminating risk factors and developing healthy lifestyle habits.</p>	Knows	Factors of virulence of the microorganism, their role in the development of the pathological process.
	Knows how	To determine the source of infection, the type of microorganism, its degree of danger, ways of transmission and the conditions for the occurrence of the infection process.
	Has the skill	To ensure safety and protection against pathogenic and conditionally pathogenic microorganisms.

**I. STRUCTURE AND CONTENT OF THEORETICAL PART OF  
THE COURSE**

№	The name of the lecture topics of the discipline (module)	Hours
<b>4 semester</b>		
<b>Module 1</b>	<b>General Microbiology</b>	
1.	The subject, tasks, main historical stages of development of microbiology, virology, immunology. Principles of classification. Morphology and structure of the main forms of microorganisms (bacteria, fungi, rickettsia, mycoplasma, chlamydia, spirochetes).	2
2.	The physiology of microorganisms, their chemical composition, nutrition and its provision in the laboratory. Breathing, reproduction. Microbiological research method.	2
3.	Morpho-structural organization and physiology of viruses, their reproduction, methods of cultivation and indication. Bacteriophagy and its practical significance.	2
4.	<b>Ecological microbiology. Human microflora.</b> Forms of relationships between microbes and other biological objects. Exogenous and endogenous microflora. The microflora of individual organs and systems of the human body. The concept of biofilm. Basics of chemoprophylaxis and chemotherapy of infectious diseases.	2
5.	Genetics: heredity and variability of microorganisms, scientific and practical value.	2
6.	<b>The study of infection and the infectious process.</b> The role of microorganisms, macroorganism and the environment in the development of the infectious process. Pathogenicity, virulence of microbes.	2
7.	<b>Immunity.</b> The value of the human immune system in the diagnosis, treatment and prevention of infectious diseases. Non-specific protection of the body against infections. The doctrine of specific immunity. Antigens, their material basis, functions, types. Antibodies. Immunological methods for the diagnosis of infectious diseases.	2
8.	<b>Specific and non-specific prophylaxis.</b> Immunization and immunotherapy, their importance in medicine. Vaccines and immune sera. Toxins and Anatoxins.	2
<b>Module 2</b>	<b>Sanitary bacteriology</b>	2
9.	Fundamentals of environmental health microbiology. Hospital infections, etiology and prevention.	2
	Total hours per semester	18

<b>5 semester</b>		
<b>Module 3</b>	<b>Medical microbiology</b>	
10.	Clinical microbiology of colibacillosis and shigellosis, salmonellosis - typhoid and paratyphoid fever.	2
11.	Microbiology of food poisoning - toxicoinfections and intoxications. Clinical microbiology of causative agents of cholera and other vibrios (halophillosis).	2
12.	Microbiology of bacterial zoonoses - brucellosis, anthrax, tularemia, plague.	2
13.	Microbiology of purulent infections - staphylococcosis and streptococcosis. Microbiology of anaerobic wound infections - gas gangrene, tetanus.	2
14.	Clinical microbiology of diphtheria, bordetellosis, legionellosis, tuberculosis.	2
15.	Clinical mycology: superficial and deep mycoses.	2
16.	Causative agents of viral intestinal infections: enteric infections, viruses of the ECHO group, Coxsacke A and B, polio, hepatitis A, E, viral gastroenteritis.	2
17.	Respiratory (pneumotropic) viral infections - influenza, parainfluenza, ARVI, adenovirus infections, etc.	2
18.	Viral hepatitis, viral hemorrhagic fevers (Dengue fever, Crimean hemorrhagic fever, HFRS, Ebola fever).	2
	Total hours per semester	18

## II. STRUCTURE AND CONTENT OF A PRACTICAL COURSE

### Practical lessons (72 hours)

<b>№</b>	<b>The name of the practical classes of educational discipline (module)</b>	<b>Hours</b>
<b>4 semester</b>		
Theme 1.	<p><b>Organization, equipment, microbiological laboratory mode - general and special purpose. Microscopic method of research. Systematics and nomenclature of microorganisms. The main forms of bacteria. Sizes of bacterial cells.</b></p> <p>Definition of the concepts of "classification", "nomenclature" and "identification" of bacteria. The essence of the binary principle of the nomenclature of bacteria. The principles of modern classification of microbes. Taxonomic categories (kingdom, department, family, genus, species). The main differences between prokaryotes and eukaryotes, prokaryotes and viruses. The nuclear apparatus of bacteria, in contrast to the genome of the eukaryotic cell.</p>	2



Theme 2	<p><b>Microscopic examination method. Tinctorial properties and structure of bacteria. Simple and complex staining methods. The structure of the bacterial cell.</b></p> <p>Permanent and non-permanent structures of the bacterial cell: nucleoid, cytoplasm, lysosomes, MTC, ribosomes, cell wall, spore, capsule, villi (pili), flagella, inclusions. Features of the structure and staining of Gr + and Gr-bacteria. Structure of the cytoplasmic membrane and cell wall. The chemical composition and functional significance of individual organs. Spores and capsules. The mechanism of sporulation in bacteria. Sub-cellular forms of bacteria: protoplasts, spheroplasts, L-forms of bacteria. Basic methods for studying the morphology of bacteria. Simple and complex methods of microbes staining and their individual structures. Gram, Ziehl-Nielsen, Neisser, Burri-Hins methods. Mechanisms of dye interaction with bacterial cell structures.</p>	2
Theme 3	<p><b>The morphology and structure of other microorganisms: spirochete, rickettsia, fungi, mycoplasma, chlamydia.</b></p> <p>Methods for their detection. Dark field microscopy, phase-contrast, luminescent, electron microscopy, scanning method of research.</p>	2
Theme 4	Microscopic method of research - test seminar.	2
Theme 5	<p><b>Microbial physiology. Nutrition and its provision in the laboratory: nutrient media. Sterilization, disinfection, quality control.</b></p> <p>Sources of nitrogen, carbon, mineral substances, growth factors. Enzymes of microorganisms, their classification. Permanent and non-permanent enzymes, genetic regulation. The specificity of enzymes. Enzymes of pathogenicity. Methods for studying the enzymatic activity of bacteria and its use for the identification of bacteria (culture and biochemical). The use of enzymes in the microbiological industry. The speed and phases of reproduction in standard conditions. Nutrient requirements. Classification of nutrient media.</p>	3
Theme 6	<p><b>The physiology of microbes - respiration.</b> Aerobes, anaerobes, facultative anaerobes, microaerophiles. Pigments. Principles and conditions for the cultivation of bacteria. The concept of a pure microbe culture, strain, clone. Cultural properties, microbiological research method: isolation of a pure culture of aerobes, anaerobes, principles of microbial species identification. Ways to create anaerobic conditions. Nutrient media used for the cultivation of anaerobes.</p>	2
Theme 7	Cultivation of other microorganisms - fungi, protozoa, rickettsia, chlamydia.	2
Theme 8	<b>Determination of bacterial sensitivity to medicinal sub-</b>	2

	<b>stances. Basics of chemoprophylaxis and chemotherapy.</b> The history of chemotherapy. Microbial antagonism, its mechanisms. Antibiotics, their classification (by chemical structure, mechanism, spectrum of action). The concept of the minimum inhibitory concentration (MIC) and therapeutic dose. Methods for studying the sensitivity of bacteria to antibiotics <i>in vitro</i> .	
Theme 9	Viruses - morphology and physiology. Methods of cultivating viruses and principles of their indication.	2
Theme 10	Bacterial viruses - bacteriophages. Isolation of bacteriophages from different objects, establishment of species, titer. The use of bacteriophages in science, medicine, national economy.	2
Theme 11	<b>Ecological microbiology. Genetics and variability of microorganisms.</b> The concept of geno- and phenotype. Forms of variation: genotypic, phenotypic. Modification variability, its mechanisms and manifestations in bacteria. Genotypic variability: mutations. PCR.	2
Theme 12	<b>Infection and infectious process, the role of microbes in their development.</b> Conditions for the occurrence of an infectious process. The role of microorganisms in the infectious process. Forms of interaction of micro and macroorganisms. Pathogenicity of microorganisms. Virulence, definition, units of measurement. Characteristics of pathogenicity factors (adhesion, colonization, penetration, invasion, aggression). Exotoxins and endotoxins.	2
Theme 13	<b>Immunity, the body's natural resistance to infection.</b> Types of immunity. The immune system of the human body and its organization. Main functions. The central and peripheral organs of the immune system.	2
Theme 14	Antigens, antibodies, the fate of the antigen in the body. Specific immunity.	2
Theme 15	<b>Immunological methods of diagnosis.</b> Agglutination reaction and its variants. Reactions of lysis: bacteriolysis, cytolysis (hemolysis), CSC, neutralization reaction, immunoluminescent (RIF, PHIF), immunoenzymatic (ELISA) and immunoradiological (IRA).	2
Theme 16	Immunoprophylaxis, immunotherapy. Vaccines, immune sera. Methods and means of intra- and extracorporeal immunocorrection. Immune engineering.	2
Theme 17	Sanitary microbiology of environmental objects.	2
Theme 18	Test session.	2
	Total hours per semester	36

<b>5 semester</b>		
Theme 19	<p style="text-align: center;"><b>Microbiology of colibacillosis, shigellosis, salmonellosis (typhoid, paratyphoid).</b></p> Characterization of pathogens of intestinal bacterial infections: colibacillosis, dysentery, typhoid and paratyphoid A and B, salmonella. Principles of laboratory diagnosis. Specific and non-specific prevention. Drugs for etiologic therapy.	2
Theme 20	<p style="text-align: center;"><b>Microbiology of foodborne infections and intoxications.</b></p> Characteristics of pathogens. Principles of laboratory diagnostics. Specific and non-specific prevention. Drugs for etiologic therapy.	2
Theme 21	Microbiology of cholera and halophillosis.	2
Theme 22	Microbiology of bacterial zoonoses - brucellosis, tularemia, anthrax, yersiniosis.	2
Theme 23	Microbiology of staphylococci and streptococcosis, their role in the development of nosocomial infections. Nosocomial infections.	2
Theme 24	Microbiology of neisseriosis (meningeal and gonococcal infections) and pneumococcosis.	2
Theme 25	Microbiology of wound (gas gangrene, tetanus) and food (botulism) anaerobiosis.	2
Theme 26	<p style="text-align: center;"><b>Microbiology of corynebacteriosis (diphtheria) and bordetellosis (whooping cough, paracoccosis).</b></p> Taxonomy and characterization. Microbiological diagnosis. Specific and non-specific prevention and treatment.	2
Theme 27	<b>Microbiology of mycobacteriosis - tuberculosis, leprosy.</b>	2
Theme 28	<b>Microbiology of spirochetosis - treponematosis (syphilis), borreliosis (relapsing fever), leptospirosis.</b>	2
Theme 29	<p style="text-align: center;"><b>Microbiology of rickettsiosis (epidemic, endemic) and chlamydia.</b></p> Morphology, physiology, antigenic characterization of pathogens, pathogenesis, clinical features of infections, immunity. Diagnosis, prevention and principles of treatment.	2
Theme 30	<p style="text-align: center;"><b>Microbiology of protozoa.</b></p> Morphology, physiology, antigenic characterization of pathogens, pathogenesis, clinical features of infections, immunity. Diagnostics, principles of prevention and therapy.	2
Theme	<b>Clinical mycology.</b>	2

31	Morphology, physiology, antigenic characterization of pathogens, pathogenesis, clinical features of infections, immunity. Diagnosis of mycoses, the principles of prevention and therapy.	
Theme 32	<b>Microbiology of respiratory viral infections.</b> Influenza, paramyxoviruses, measles, epidemic paratitits, rubella, coronaviruses, adenoviruses, reoviruses. Taxonomy. Characteristics of pathogens. Principles of laboratory diagnostics. Specific prevention and treatment.	2
Theme 33	<b>Microbiology of acute intestinal viral infections.</b> Causative agents of enterovirus infections, viruses group ECHO, Coxsacke A and B, polio. Principles of laboratory diagnostics. Treatment, specific and non-specific prophylaxis.	2
Theme 34	<b>Microbiology of viral hepatitis.</b> Characteristics of pathogens, pathogenesis, clinical features of infection. Principles of laboratory diagnostics. Treatment, specific and non-specific prophylactic.	2
Theme 35	<b>Microbiology of viral hemorrhagic fevers</b> (Dengue fever, Crimean hemorrhagic fever, HFRS, Ebola fever).	2
Theme 36	<b>HIV infection.</b> Characteristics of pathogens, pathogenesis, clinical features of infection. Diagnosis, material, methods of analysis, prevention, principles of therapy. HIV-related infections, their types. Principles of therapy and prevention.	2
	Total hours per semester	36

## **LABORATORY WORKS (36 hours)**

### **Semester 4 (18 hours).**

**Laboratory work № 1.** Work in the microbiological laboratory. Device and equipment of microbiological laboratory. Rules of conduct in the laboratory. Requirements for microbiological laboratories. Microscope. Types of microscopes.

**Laboratory work № 2.** The morphology of bacteria. Preparation of micropreparations. Simple staining methods.

**Laboratory work № 3.** The structure of a bacterial cell. Complex staining methods. Gram staining method.

**Laboratory work № 3.** Characteristics of optional structures. Their identification by complex coloring methods.

**Laboratory work № 4.** Features of morphology and methods of detection

of fungi, protozoa, spirochetes, actinomycetes, rickettsiae, chlamydia, mycoplasmas.

**Laboratory work № 5.** The physiology of microorganisms. Types and mechanisms of nutrition of bacteria. Nutritional media. Cultivation of bacteria.

**Laboratory work № 6.** The effect of physical, chemical and biological factors on microorganisms. Disinfection and disinfectants. Concentration calculations. The concept of aseptic, antiseptic, conservation. Sterilization. Methods, equipment, sterilization regime, sterilized material. Control of the mode of sterilization. Mode tables.

**Laboratory work № 7.** Growth, reproduction and respiration of bacteria. Isolation of pure aerobic culture. Methods for studying the biochemical properties of pure culture.

**Laboratory work № 8.** Methods for isolation of pure culture of anaerobes. Methods for the cultivation of anaerobes. Methods for studying the biochemical properties of pure culture.

**Laboratory work № 9.** Infection. Virulence factors. Study of virulence factors (capsulation, hemolysin, plasma coagulase, R and S forms of colonies). Basic reactions and tests for the determination of quantitative and qualitative assessment of virulence factors.

#### **Semester 5. (18 hours).**

**Laboratory work № 10.** Methods for determining the sensitivity of microorganisms to antibiotics (disco-diffusion, serial dilutions, etc.). Records of the results of the disco-diffusion method.

**Laboratory work № 11.** Viruses. Methods of cultivation, typing.

**Laboratory work № 12.** Bacteriophages. Methods of typing and identification.

**Laboratory work № 14.** Basic immunological reactions (agglutination, precipitation, CSC, immobilization, etc.).

**Laboratory work № 15.** Serological methods for the diagnosis of infectious diseases (RNGA, ELISA, REEF, etc.).

**Laboratory work № 16.** Molecular genetic studies. PCR. PCR types, errors and difficulties, advantages of methods.

**Laboratory work № 17.** Sanitary and microbiological study of water, air, soil: indicators, methods for their determination, standards. Sanitary and microbiological research of washes from hands and objects of the external environment (pharmacy ware, equipment).

**Laboratory work № 18.** Test session. Practical skills test.

### III. METHODOLOGICAL SUPPORT OF INDEPENDENT WORK OF STUDENTS

The educational and methodological support for the independent work of students in the discipline "Microbiology, Virology" is presented in Application 1 and includes:

- the schedule for the implementation of independent work on the discipline, including the approximate standard time to perform for each task;
- characteristics of tasks for independent work of students and methodological recommendations for their implementation;
- requirements for the presentation of the results of independent work;
- criteria for assessing the performance of independent work

### IV. CONTROL OF COURSE GOALS ACHIEVEMENT

№	Controlled sections/topics of discipline	Codes and stages of the competencies formation			Evaluation tools	
					Current control	Intermediate certification
1	Sections 1-3. General microbiology. Introduction to microbiology. Morphology and	PC-3	Knows	basic physicochemical, mathematical and other natural science concepts and methods in solving professional problems	Quiz Test Presentation	1, 3, 5-6, 8-11, 15-18, 24-30, 34,

	classification of microorganisms. The physiology of microorganisms.					45-46 /1, 26, 27, 39
			Knows how	to use of basic physicochemical, mathematical and other natural science concepts and methods in solving professional problems	Situational challenge	
			Has the skill	to use of basic physicochemical, mathematical and other natural science concepts and methods in solving professional problems	Test	
	Genetics of microorganisms.	PC-3	Knows	the process of conduction of laboratory and other studies in order to recognize the state or establish the fact of the presence or absence of the disease	Quiz Test Presentation	2, 4, 7, 12- 14, 23, 39-40, 41- 44/16
			Knows how	to conduct laboratory and other studies in order to recognize the state or establish the fact of the presence or absence of the disease	Situational challenge	
			Has the skill	to conduct laboratory and other studies in order to recognize the state or establish the fact of the presence or absence of the disease	Test	
2	Sections 4-7. General microbiology. Antimicrobial drugs. Infectious process. Immunity.	PC-16	Knows	new areas of research and problems in the development of biochemical and physicochemical technologies in health care.	Quiz Test Presentation	19-22, 31-33, 35-38, 47/1
			Knows how	to identify new areas of research and problems in the development of biochemical and physico-chemical technologies in health care.	Situational challenge	
			Has the skill	to identify new areas of research and problems in the development of biochemical and physico-chemical technologies in health care.	Test	

Sections 8-9. Medical microbiology. Pathogens with fecal-oral transmission mechanism. Pathogens with respiratory transmission mechanism.	PC-3	Knows	The assessment of morphofunctional, physiological states and pathological processes in the human body to solve professional problems.	Quiz Test Presentation	-/2- 10, 20, 21-22, 25, 28-31, 34-35, 40-41, 42-47
		Knows how	To assess morphofunctional, physiological states and pathological processes in the human body to solve professional problems.	Situational challenge	
		Has the skill	To assess morphofunctional, physiological states and pathological processes in the human body to solve professional problems.	Test	
	PC-3	Knows	The laboratory and other studies in order to recognize the condition or establish the fact of the presence or absence of the disease.	Quiz Test Presentation	
		Knows how	To conduct laboratory and other studies in order to recognize the condition or establish the fact of the presence or absence of the disease.	Situational challenge	
		Has the skill	To conduct laboratory and other studies in order to recognize the condition or establish the fact of the presence or absence of the disease.	Test	
Sections 10-11. Medical microbiology. Pathogens of infections with the blood mechanism of transmis-	PC-16	Knows	The assessment of morphofunctional, physiological states and pathological processes in the human body to solve professional problems.	Quiz Test Presentation	-/ 11- 15, 17-19, 23-24, 32-33, 36-38,



sion. Causative agents of infections with a contact mechanism of transmission		Knows how	To assess morphofunctional, physiological states and pathological processes in the human body to solve professional problems.	Situational challenge	
		Has the skill	To assess morphofunctional, physiological states and pathological processes in the human body to solve professional problems.	Test	
	PC-3	Knows	The laboratory and other studies in order to recognize the condition or establish the fact of the presence or absence of the disease.	Quiz Test Presentation	
		Knows how	To conduct laboratory and other studies in order to recognize the condition or establish the fact of the presence or absence of the disease.	Situational challenge	
		Has the skill	To conduct laboratory and other studies in order to recognize the condition or establish the fact of the presence or absence of the disease.	Test	

Standard control tasks, methodological materials, determining the procedures for evaluating knowledge and skills and (or) experience of the activity, as well as the criteria and indicators necessary for evaluating knowledge and skills and describing the stages of formation of competences in the process of mastering the educational program are located in Application 2.

## **V. LIST OF EDUCATIONAL LITERATURE PROVISION OF THE DISCIPLINE**

### **Main literature**

*(electronic and print publications)*

4. Jawetz Melnick & Adelbergs Medical Microbiology 26 E (Lange) 26th Edition. Textbook. Karen C. Carroll, Janet S. Butel, Stephen A. Morse., 2013, 877 pages.
5. Prescott Harley Klein's Microbiology 7th Edition. Textbook. Joanne Willey, Linda Sherwood, Chris Woolverton., 2007, 1088 pages.
6. Review of Medical Microbiology and Immunology (Lange Medical Books) 13th Edition. Textbook. Warren Levinson., 2014, 800 pages.

### **List of Internet resources**

1. <https://www.ncbi.nlm.nih.gov/>
2. <https://microbiologyinfo.com/>
3. <https://www.microbes.info/>
4. <http://www.highveld.com/microbiology/micro.html>
5. <https://microbiologyonline.org/>
6. <https://microbiologysociety.org/>

### **LIST OF INFORMATION TECHNOLOGIES AND SOFTWARE**

<b>The location of the computer equipment on which the software is installed, the number of jobs</b>	<b>List of licensed software</b>
Multimedia audience	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.

### **I.METHODICAL INSTRUCTIONS FOR THE DISCIPLINE**

The discipline "Microbiology, virology" is studied during the second and third year of study. Forms of control - credit in the 4th semester (the second year of study) and the exam in the 5th semester (the third year of study). During the periods of study, the main types of studies are lectures, practical, laboratory studies and independent work of students.

During the lectures, the basic concepts of topics related to them, theoretical and practical problems, recommendations for independent work and preparation for laboratory studies are given.

In the course of practical and laboratory classes, students' knowledge on a number of general issues of microbiology discussed during lectures, the most important microbiological concepts of morphology and physiology of microorganisms is deepened and consolidated. During preparation for practical and laboratory classes, a student should:

- get admission to work in the laboratory, having familiarized with the instruction on labor protection at the department;
- to study the theory of practical and laboratory work, using lecture notes and recommended literature;
- familiarize yourself with the test questions for laboratory work and be ready to answer them during the admission to work;
- draw up a plan for performing experiments taking into account safety regulations.

In the process of preparing for practical and laboratory studies students can use the advice of the teacher. At the end of the work:  make appropriate conclusions based on the experiments;  show work results.

Questions of the work program of the discipline, not included in the classroom work, should be studied by students in the course of independent work. Students' independent work control over the course curriculum is carried out by oral survey or through testing. In the course of independent work, each student is obliged to read the main and, if possible, additional literature on the topic being

studied, to supplement the lecture notes with missing material, extracts from recommended sources.

When studying the discipline "Microbiology, virology" the following types of independent work of students are used: search for the literature on a given topic (including electronic sources of information), a comparative analysis of scientific publications; presentation on the specified topics; writing an essay, preparing and participating in scientific student conferences.

To prepare for classes, current control and intermediate certification, students can use the FEFU Scientific Library, the electronic catalog of which is located at the e-mail address [www.dvfu.ru/library](http://www.dvfu.ru/library), where they have the opportunity to access educational materials of a university library and other electronic library systems.

## **II. MATERIAL AND TECHNICAL SUPPORT OF THE DISCIPLINE**

### **LOGISTICS DISCIPLINE**

For practical work, as well as for the organization of independent work, students have access to the following laboratory equipment and specialized classrooms that meet the current sanitary and fire regulations, as well as safety requirements during training and scientific and industrial works:

<b>Name of the equipped rooms and rooms for independent work</b>	<b>List of main equipment</b>
The computer class of the School of biomedical AUD. M723	<p>Screen, electrically 236*147 cm to trim the screen; Projector DLP technology, 3000 ANSI LM, WXGA with 1280x800 resolution, 2000:1 Mitsubishi EW330U; Subsystem of specialized mounting equipment course-2007 Tuarex; Subsystem of videocommunity: matrix switch DVI and DXP 44 DVI Pro advertising; extension cable DVI over twisted pair DVI 201 TX/RX advertising; Subsystem of audiocommentary and sound; speaker system for ceiling si 3ct LP Extron on from; digital audio processor DMP 44 LC the Extron; the extension for the controller control IPL T CR48; wireless LAN for students is provided with a system based on 802.11 a/b/g/N 2x2 MIMO(2SS) access points.</p> <p>Monoblock HP Loope 400 all-in-one 19.5 in (1600x900), core i3-4150t, 4GB DDR3-1600 (1x4GB), 1TB HDD 7200 SATA, and a DVD+ / -RW, GigEth, Wi-Fi and BT, the USB port of roses/MSE, Win7Pro (64-bit)+Win8.1Pro(64-bit), 1-1-1 Wty</p>

<p>690922, Primorsky Krai, Vladivostok, island Russian, the Saperny Peninsula, the village of ayaks, 10, RM. M 422</p> <p>Multimedia audience</p>	<p>Multimedia audience:</p> <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 - Codeonly - 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>Reading rooms of the Scientific library of the University open access Fund (building a - 10)</p>	<p>Monoblock HP Loope 400 All-in-One 19.5 in (1600x900), Core i3-4150T, 4GB DDR3-1600 (1x4GB), 1TB HDD 7200 SATA, DVD+/-RW, GigEth, wifi, BT, usb kbd/mse, Win7Pro (64-bit)+Win8.1Pro(64-bit), 1-1-1 Wty Speed Internet access 500 Mbps. Jobs for people with disabilities equipped with displays and Braille printers.; equipped with: portable reading devices flatbed texts, scanning and reading machines videovelocity with adjustable color spectrums; increasing electronic loops and ultrasonic marker</p>
<p>690922, Primorsky Krai, Vladivostok, island Russian, the Saperny Peninsula, Ayaks, 10, RM. M 425</p>	<p>Microbiology laboratory:</p> <p>Microscope Biomed (12 PCs), camera, monocular microscope, microscope "Mikromed-5 LOOM", the count of colonies of microorganisms SCM-1, refrigerator Ocean RFD-325B, anaerostat, homogenizer, balances, water distiller, thermostatic water T-250, the electric stove "Dream", laboratory glassware.</p>

Medical Center of the Federal State Autonomous Educational Institution of Higher Professional Education "Far Eastern Federal University".



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

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

**On the discipline «Microbiology, virology»**

**Specialty 30.05.01 «General medicine»**

**Full-time course**

**Vladivostok**

**2017**

## Schedule of the independent work on the discipline

No	Date / Deadline	Type of independent work	Estimated time limits for execution	Form of control
<b>4 semester</b>				
1	2-6 weeks	Essay	6 hours	YO-3- Report
2	7-16 weeks	Presentation	8 hours	YO-3- Report
3	11-16 weeks	Course work	9 hours	Report
4	17-18 weeks	Preparation for the offset	7 hours	YO-1- Interview IIP-1 - Test
<b>5 semester</b>				
1	2-6 weeks	Essay	6 hours	YO-3- Report
2	7-16 weeks	Presentation	8 hour	YO-3- Report
3	11-16 weeks	Course work	9 hours	Report
4	17-18 weeks	Preparation for the exam	10 hours	YO-1- Interview

### Guidelines for writing and design of the abstract

**Essay** – the creative activity of the student, which reproduces in its structure research activities on solving theoretical and applied problems in a certain branch of scientific knowledge. Because of this essay is an essential component of the educational process in high school.

The essay, being a model of scientific research, is an independent work in which a student solves a problem of a theoretical or practical nature, applying the scientific principles and methods of this branch of scientific knowledge. The result of this scientific search can have not only subjective, but also objective scientific novelty, and therefore can be presented for discussion by the scientific community in the form of a scientific report or a message at a scientific-practical conference, as well as in the form of a scientific article.

The essay implies the acquisition of skills for building business cooperation based on the ethical standards of scientific activity. Purposefulness, initiative, disinterested cognitive interest, responsibility for the results of their actions, conscientiousness, competence - personality traits that characterize the subject of research activities corresponding to the ideals and norms of modern science.

The essay is an independent educational and research activity of the student. The teacher assists in a consultative manner and assesses the process and the results of the activity. He provides an approximate topic of essay, specifies the problem and topic of research, helps to plan and organize research activities, assigns time and a minimum number of consultations.

The teacher accepts the text of the essay for verification at least ten days before the presentation.

Traditionally, a certain structure of the essay has been formed, the main elements of which in order of their location are the following:

1. Title page.
2. The task.
3. Table of contents.
4. List of symbols and terms (if necessary).
5. Introduction.
6. Main part.
7. Conclusion.
8. Bibliographic list.
9. Applications.

The title page includes: educational institution, graduating department, author, teacher, research topic, place and year of the essay.

The title of the abstract should be as short as possible and fully consistent with its content.

The table of contents reflects the names of the structural parts of the abstract and the pages on which they are located. The table of contents should be placed on one page at the beginning of the work.

The presence of a detailed introduction - a necessary requirement for the abstract. Despite the small volume of this structural part, its writing causes considerable difficulties. However, it is a qualitatively executed introduction that is the key to understanding the entire work, which testifies to the author's professionalism.

Thus, the introduction is a very crucial part of the essay. The introduction



should start with a justification of the relevance of the chosen topic. As applied to the essay, the concept of "relevance" has one feature. From how the author of the essay can choose a topic and how correctly he understands and evaluates this topic from the point of view of modernity and social significance, characterizes his scientific maturity and professional readiness.

In addition, in the introduction it is necessary to isolate the methodological basis of the abstract, to name the authors, whose works constituted the theoretical basis of the study. A review of the literature on the topic should show the author's acquaintance with special literature, his ability to systematize sources, critically examine them, highlight the essential, determine the most important in the current state of knowledge of the topic.

The introduction reflects the meaning and relevance of the chosen topic, defines the object and subject, goal and objectives, chronological framework of the study.

The introduction ends with a presentation of general conclusions about the scientific and practical significance of the topic, the degree of its knowledge and sources, and the hypothesis being put forward.

The main part describes the essence of the problem, the topic revealed, the author's position, given factual material. The author must demonstrate the ability to consistently present the material while analyzing it simultaneously. Preference is given to the main facts, rather than small details.

The essay ends with the final part, which is called "the conclusion". Like any conclusion, this part of the abstract serves as a conclusion, due to the logic of the study, which is a form of synthesis of scientific information accumulated in the main part. This synthesis is a consistent, coherent presentation of the results obtained and their relation to a common goal and specific tasks set and formulated in the introduction. This part contains the so-called "output" knowledge, which is new in relation to the original knowledge. The conclusion may include suggestions of a practical nature, thereby increasing the value of theoretical materials.

So, in conclusion of the essay should be:

- a) presented the findings of the study;
- б) theoretical and practical significance, the novelty of the essay;
- в) indicated the possibility of applying the results of the study.

After the conclusion, it is customary to place a bibliographic list of used literature. This list is one of the essential parts of the essay and reflects the independent creative work of the author of the abstract.

The list of sources used is placed at the end of the work. It is made or in alphabetical order (by the name of the author or the name of the book), or in the order in which the references appear in the text of the written work. In all cases, the full title of the work, the names of the authors or the editor of the publication are indicated if the writing team involved a group of authors, data and the number of volume, the name of the city and publisher in which the work was published, year of publication, number of pages.

### **Methodical recommendations for the preparation of presentations**

For the presentation preparation it is recommended to use: PowerPoint, MS Word, Acrobat Reader, LaTeX beamer. The simplest program for presentations creating – Microsoft PowerPoint. To prepare the presentation, it is necessary to process the information collected while writing the essay.

#### **Presentation preparation sequence:**

1. Clearly stated the purpose of the presentation.
2. Determine what the presentation format will be: live performance (then how long it will be) or e-mail (what the presentation context will be).
3. Select the entire content of the presentation and build a logical chain of presentation.
4. Identify key points in the content of the text and highlight them..
5. Determine the types of visualization (pictures) to display them on slides in accordance with the logic, purpose and specificity of the material.
6. Choose a design and format slides (the number of pictures and text, their location, color and size).
7. Check the visual perception of the presentation.

**The types of visualization include:** illustrations, images, diagrams, tables.

- A. Illustration is a representation of a real-life visual form.
- B. The images - as opposed to illustrations - are a metaphor. Their purpose is to evoke emotion and create an attitude towards it, to influence the audience. With the help of well-designed and presented images, information can remain permanently in a person's memory.
- C. Chart - visualization of quantitative and qualitative relationships. They are used for convincing data demonstration, for spatial thinking in addition to the logical one.
- D. Table - specific, visual and accurate data display. Its main purpose is to structure information, which sometimes facilitates the perception of data by the audience.

### **Practical tips on presentation preparation**

- text + slides + handouts are prepared separately;
- slides – visual presentation of information, which should contain a minimum of text, a maximum of images that carry meaning, look visually and simply;
  - text content – speaking or reading, which should include arguments, facts, evidence, and emotions;
  - recommended number of slides 17-22;
  - necessary information for the presentation: subject, surname and initials of the speaker; plan; brief conclusions; list of sources used;
  - handout material – must provide the same depth and coverage as the live performance: people trust more to what they can carry with them than to disappearing images, words and slides which can be forgotten; handouts are important to hand out at the end of the presentation; handouts should be different from slides, should be more informative.

### **Essay evaluation criteria.**

The stated understanding of the abstract as a holistic copyright text defines the criteria for its evaluation: the novelty of the text; the validity of the choice of source; the degree of disclosure of the essence of the issue; compliance with the requirements for registration.

**Text novelty**: а) relevance of the research topic; б) novelty and independence in the formulation of the problem, the formulation of a new aspect of the well-known problem in the establishment of new connections (interdisciplinary, intradisciplinary, integration); в) ability to work with research, critical literature, systematize and structure the material; г) manifestation of the author's position, independence of assessments and judgments; д) stylistic unity of the text, the unity of genre features.

**The degree of disclosure of the essence of the question**: а) plan compliance with the topic of the essay; б) соответствие содержания теме и плану реферата; в) compliance with the content of the topic and plan of the abstract; г) the validity of the methods and methods of working with the material; е) ability to generalize, draw conclusions, compare different points of view on one issue (problem).

**The validity of the choice of sources**: а) evaluation of used literature, whether the most famous works on the research topic involved (including recent journal publications, latest statistics, summaries, references, etc.).

**Compliance with the requirements for design**: а) whether the references to the used literature written correctly; б) literacy and presentation culture evaluation (including spelling, punctuation, style), mastery of terminology; в) compliance with the requirements for the abstract.

**The reviewer** must clearly formulate the remark and questions, preferably with references to the work (if it is possible on the specific pages of the work), to the research and the actual data that the author did not take into account..

**The reviewer** may also specify: whether the student addressed the topic earlier (abstracts, written works, creative works, olympiad works, etc.) and there are

any preliminary results; how did the student work (plan, intermediate stages, consultation, revision and processing of written or lack of a clear plan, rejection of the recommendations of the head).

**The student** submits an essay for review no later than a week before the presentation. The reviewer is the teacher. It is advisable to acquaint the student with the review a few days before the presentation. Teacher choose opponents among students. For an oral presentation, a student needs about 10–20 minutes (approximately, as long as he answers on the exam).

**Grade 5** is set if all the requirements for writing and presentation of the essay are met.: indicated the problem and justified its relevance, a brief analysis of various points of view on the problem is made and own position is logically presented, conclusions are formulated, the topic is fully disclosed, the requirements for appearance are met, the correct answers to additional questions are given.

**Grade 4** is set if the main requirements for the essay and its presentation are met, but there are some shortcomings. In particular, there are inaccuracies in the presentation of the material; no logical sequence in judgments; there are omissions in the design; the incomplete answers are given for the additional questions.

**Grade 3** is set if the there are significant deviations from the requirements for referencing. In particular: the topic is covered only partially; factual errors in the content of the essay or when answering additional questions are made.

**Grade 2** is set if the topic of the essay is not disclosed, there is a significant misunderstanding of the problem.

**Grade 1** is set if student's essay is not presented.

### **Topics for self-study**

1. The role of Mechnikov in the formation of the theory of immunity, infectology, epidemiology.
2. Pathogenicity and virulence. Major pathogenic factors.
3. The role of the microorganism in the development of the infectious process.

4. Principles of microbial identification. Definition. Molecular-genetic methods for the identification of microorganisms.
5. Bacterial cell structure. Characteristics of optional structures: spores, flagella, villi, inclusions. Plasmids. Capsules. Their identification and significance.
6. Mycology. Features of morphology and fungi detection methods. Methods for the diagnosis of fungal diseases. Specific prevention and treatment.
7. Virology. Features of morphology, physiology and virus detection methods. Methods for diagnosis of viral diseases. Specific prevention and treatment.
8. Rickettsiology. Features of morphology, physiology and methods of detection of rickettsia.
9. Mycoplasmaology. Features of morphology, physiology and methods of detection of mycoplasmas. Methods of diagnosis of diseases caused by mycoplasmas. Specific prevention and treatment.
10. Bacteriological method for the diagnosis of infectious diseases. Its advantages and disadvantages. Accelerated methods.
11. Bacterial enzymes. Practical importance. Role in the identification of bacteria.
12. Conditionally pathogenic bacteria. Classification. Their role in the infectious process.
13. The value of the human immune system in the diagnosis, treatment and prevention of infectious diseases.
14. Principles of laboratory diagnosis of infectious diseases. Treatment, specific and non-specific prophylaxis. Drugs for etiotropic therapy and specific prophylaxis.
15. Polymerase chain reaction. Principle of the method. Practical use.
16. General and applied immunology. Types and forms of immunity. Congenital immunity factors.
17. Bacterial infections (plague pathogens, tularemia, borreliosis etc.). Principles of laboratory diagnosis. Treatment, specific and non-specific prevention.

Drugs for etiologic therapy and specific prophylaxis.

18. Salmonella-induced toxic infections. Etiology and pathogenesis of toxic infections. Clinical manifestations and prevention.

19. Staphylococcal intoxication, prevention. Etiology and pathogenesis of staphylococcal intoxication. Clinical manifestations and prevention.

20. Botulism. Etiology and pathogenesis of bacteriotoxicosis. Clinical manifestations of botulism. Preventive actions.

21. Mycotoxicosis. Etiology and pathogenesis of mycotoxicosis. Classification of mycotoxicosis. Clinical manifestations of the most common mycotoxicosis. Preventive actions.

22. Viral infections - HIV pathogens. Principles of laboratory diagnosis. Treatment, specific and non-specific prophylaxis. Preparations for etiologic therapy and specific prophylaxis.

**Recommended topics for reports (presentations) in the section "General Microbiology, Virology":**

1. Adaptation of microorganisms to extreme environmental conditions.
2. The organization of genetic material in bacteria. Stability and variability of the bacterial genome.
3. Horizontal gene transfer in bacteria in the laboratory and in vivo.
4. ATP molecules synthesis during aerobic growth of bacteria on media with glucose.
5. Synthesis of ATP molecules in bacteria under anaerobic conditions.
6. Growth and nutrition of microorganisms.
7. Chemical composition, organization and functions of the main bacterial structures.
8. Antimicrobial substances of bacteria.
9. Diversity and systematics of bacteria.
10. Regulation of bacterial cell metabolism.
11. Bacteria restriction and modification system.

12. Assimilation of macro- and micronutrients.
13. Oxidation of inorganic compounds by chemolithotrophs.
14. Sunlight use by prokaryotes.
15. The relationship of microorganisms with animals.
16. Virulence factors of bacteria pathogenic to humans and animals.
17. The relationship of microorganisms with plants.
18. Virulence factors of phytopathogenic bacteria.
19. Biogeochemical activity of microorganisms.
20. The use of microorganisms in medicine, agriculture, industrial technologies.
21. Microorganisms and the environment.
22. Bacterial mutants and methods for their isolation.
23. Bacterial plasmids.
24. Mobile genetic elements of bacteria.
25. Bacteriophages: particle structure, lytic cycle, lysogeny, distribution and practical use.
26. Satellite viruses and pseudvirions.
27. Viral mutations, types of viral mutants.
28. Interaction between virus and host cell.
29. Genetic interaction between viruses (complementation, recombination).
30. Non-genetic interaction of viruses (interference, phenotypic mixing).

**Recommended topics for presentations in the section "Medical Microbiology, Virology":**

1. Pathogenic cocci: staphylococci, streptococci, meningococci, gonococci.
2. Enterobacteria. Pathogenic Escherichia coli.
3. Causative agents of typhoid fever, paratyphoid, salmonella gastroenteritis
4. Shigella.



5. Pathogenic vibrios.
6. Causative agents of pseudotuberculosis and intestinal yersiniosis.
7. Causative agents of plague, tularemia, anthrax and brucellosis.
8. Pathogenic and conditionally pathogenic anaerobes: spore-forming and non-spore-forming.
9. Causative agents of rickettsioses, ehrlichiosis, bartonellosis.
10. Pathogenic chlamydia and mycoplasma.
11. Causative agents of acute respiratory viral infections.
12. Causative agents of viral intestinal infections (enteroviruses, rotaviruses, hepatitis A and E).
13. Causative agents of parenteral hepatitis.
14. Causative agents of slow viral infections.
15. HIV.

**Essay topic: «Microorganisms in my life»**

**Evaluation criteria:**

- **9 points** are awarded to a student, if a student has expressed his opinion on the formulated problem, argued it, having precisely defined its content and components. The student knows and owns the skill of independent research work on the topic of the research, methods and techniques for analyzing the theoretical and/or practical aspects of the studied area. There are no actual errors associated with the problem understanding; the work is framed correctly.

- **7-8 points** - work is characterized by semantic integrity, coherence and consistency of presentation; no more than one error was made when explaining the meaning or content of the problem. For the argument given data of domestic and foreign authors. Demonstrated research skills. There are no actual errors associated with understanding the problem. One or two mistakes in the design of the work are made.

- **6-5 points** - the student conducts a fairly independent analysis of the main stages and the semantic components of the problem; understands the basic fundamentals and theoretical justification of the chosen topic. Involved the main sources

on the subject. No more than 2 mistakes were made in the sense or content of the problem, in the design of the work.

- **4 points** - if the work is a retold or completely rewritten source text without any comments, analysis. The structure and theoretical component of the topic are not disclosed. Three or more than three mistakes were made in the content of the problem, in the design of the work.



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**SCHOOL OF BIOMEDICINE**

**EVALUATION ASSESSMENT FUND**  
**On the discipline «Microbiology, virology»**  
**Specialty 30.05.01 «General medicine»**  
**Full-time course**

**Vladivostok**

**2017**

## Evaluation criteria

*Completed in accordance with the Regulations of the Evaluation Assessment Fund of Higher Education Programs - Bachelor, Specialist, FEFA Magistrates Programs, approved by order of the Rector No. 12-13-850 of May 12, 2015.*

### The scale of the competencies formation level assessment

Code of competence	Stages of the competence formation		Points
<b>PC-3-</b> the ability and readiness to carry out anti-epidemic measures, the organization of protection of the population in the centers of especially dangerous infections, with a deterioration of the radiation situation, natural disasters and other emergency situations	Knows (threshold level)	Types of anti-epidemic measures, technical equipment and methods of protecting the population in the outbreaks of especially dangerous infections with deterioration of the radiation situation and other emergency situations.	65-71
	Knows how (advanced level)	To assess the degree of danger in the development of anti-epidemic measures, techniques and methods of protecting the population in the outbreaks of especially dangerous infections with a deterioration of the radiation situation and other emergency situations to solve professional problems	71-84
	Has the skill (high level)	Organizational skills in the areas of especially dangerous infections, with a deterioration of the radiation situation, natural disasters and other emergency situations	85-100
<b>PC-16</b> - willingness to educate on the elimination of risk factors and the formation of skills for a healthy lifestyle	Knows (threshold level)	Factors of virulence of the microorganism, their role in the development of the pathological process	65-71
	Knows how (advanced level)	To determine the source of infection, the type of microorganism, its degree of danger, ways of transmission and the conditions for the occurrence of the infection process.	71-84
	Has the skill (high level)	In providing safety and protection against pathogenic and conditionally pathogenic microorganisms.	85-100

### The scale of the competencies formation level assessment

Code of competence	Stages of the competence formation		Criteria	Indicators	Points
<b>PC-3-</b> ability and readiness to conduct anti-epidemic measures, organization of protection of the population in especially dangerous infections, with a deterioration of the radiation situation, natural disasters	Knows (threshold level)	fundamentals of a healthy lifestyle for a person as a factor of his safe life activity; occupational hazards and prevention of professional pathology of a doctor;	Types of anti-epidemic measures, equipment and methods of protection of the population in the outbreaks of particularly dangerous infections with a deterioration of the radiation situation and other emergency situations.	Calls the main anti-epidemic measures, techniques and methods of population protection in the areas of especially hazardous infections.	65-71

and other emergency situations.	Knows how (advanced level)	to teach the population the main anti-epidemic measures for organizing the protection of the population in the outbreaks of especially dangerous infections, with a deterioration of the radiation situation, natural disasters and other emergency situations.	to assess the degree of danger in the development of anti-epidemic measures, techniques and methods of protecting the population in the outbreaks of especially dangerous infections with a deterioration of the radiation situation and other emergency situations to solve professional problems	Able to assess the degree of danger, to independently develop anti-epidemic measures to protect the population in the areas of especially hazardous infections.	71-84
	Has the skill (high level)	Skills to carry out anti-epidemic measures, organization of protection of the population in the centers of especially dangerous infections, with a deterioration of the radiation situation, natural disasters and other emergency situations.	Organizational skills in the centers of especially dangerous infections, with a deterioration of the radiation situation, natural disasters and other emergency situations	Owns organizational skills in the areas of especially hazardous infections.	85-100
<b>PC-16</b> - readiness for educational activities to eliminate risk factors and develop healthy lifestyle skills	Knows (threshold level)	basics of a healthy lifestyle, the effect of microflora on health, specific and nonspecific infection prevention	Factors of the microorganism virulence, their role in the development of the pathological process	Knows the ways and mechanisms of transmission, the role of microorganism	65-71
	Knows how (advanced level)	conduct informational, educational and sanitary educational work	Determine the source of infection, the type of microorganism, its degree of danger, ways of transmission and the conditions for the an infectious process occurrence	Able to talk about the specific and nonspecific prevention of diseases caused by a particular microorganism	71-84
	Has the skill (high level)	educational skills to eliminate risk factors and develop healthy lifestyle skills	Skills to ensure safety and protection against pathogenic and conditionally pathogenic microorganisms	Owns skills for educational activities to eliminate the ways and mechanisms of transmission, and promote healthy lifestyles.	85-100

\* **Criterion** – is a sign by which one can judge the difference between one and another phenomenon. The criterion is wider than the indicator, which is an integral element of the criterion and characterizes its content. The criterion expresses the most common feature by which the evaluation, comparison of real phenomena, qualities, and processes takes place. And the degree of manifestation, qualitative formation, certainty of the criteria is expressed in specific indicators. A criterion is a necessary assessment tool, but not a rating itself. The functional role of the criterion is in determining or not determining the essential features of the object, phenomenon, quality, process, etc.

**The indicator** stands in relation to the criterion as a particular to the general. The indicator does not include universal measurement. It reflects the individual properties and characteristics of a knowable object and serves as a means of accumulating quantitative and qualitative data for criterion generalization. The main characteristics of the concept of "indicator" are concreteness and diagnostics, which implies its availability for observation, accounting and fixation, and also allows us to consider the indicator as more specific to the criterion, and therefore, the meter of the latter.

**The list of questions to the offset (4 semester):**

1. Determination of microorganisms. Taxonomy. Basic principles of microbial classification.
2. Morphological and tinctorial properties of bacteria. Staining methods. Classification. Functions.
3. The structure and chemical composition of the bacterial cell. Features of the gram-positive and gram-negative bacteria structure.
4. Viral biology features. Virus cultivation methods.
5. Principles of virus classification. Structure and chemical composition of viruses.
6. Bacteriophages. Definition. Classification.
7. Microscopic examination method. Its advantages and disadvantages. Microscopy methods (luminescent, dark-field, phase-contrast, electronic microscopy).
8. Physiology of microorganisms. Microbial metabolism.
9. Growth and reproduction of bacteria. Phases of reproduction.
10. Bacterial ways to get energy (breath, fermentation). Anaerobes cultivation methods.
11. Types and mechanisms of bacterial nutrition.
12. Basic principles of microorganism's cultivation.
13. Artificial nutrient media, classification. Nutrient requirements.
14. Microbiological research method. Its advantages and disadvantages. Principles and methods for pure bacterial cultures isolation.
15. Bacterial enzymes. Identification of bacteria by enzymatic activity.
16. Normal microflora of the human body and its functions. Dysbiosis. Eubiotics.
17. The effect of physical and chemical factors on microorganisms. The concept of sterilization, disinfection, asepsis, antiseptic.
18. Sterilization methods, equipment, sterility control.
19. The concept of chemotherapy and chemotherapy drugs. Mechanisms of action.

20. Antibiotics: classification (based on the chemical structure, on the mechanism and spectrum of action, on the source and method of obtaining).

21. Mechanisms of drug resistance of pathogenic bacteria. Ways to overcome drug resistance.

22. Methods for determining the sensitivity of bacteria to antibiotics.

23. Viruses. Types of virus-cell interaction. Phases of virus reproduction. Classification. Methods of virus cultivating.

24. Bacteriophages. Bacteriophages interaction with bacterial cell. Moderate and virulent bacteriophages. Lysogeny. The use of phages in medicine and biotechnology.

25. Bacterial genetics. The structure of the bacterial genome. The concept of genotype and phenotype. Types of variability.

26. Mechanisms of transmission of genetic material in bacteria. Bacterial plasmids, functions and properties.

27. Sanitary microbiology. Tasks, methods, practical significance.

28. Air microflora and methods of its research. Sanitary indicative air microorganisms. Bacteriological examination of air.

29. Methods of bacteriological examination of water. Water quality indicators: microbial number, coli titer, coli index.

30. Human microflora. Microbiological study of the human body microflora.

31. Infection. Conditions for the occurrence of an infectious process.

32. Stages of development and characteristic features of an infectious disease.

33. Pathogenicity and virulence of bacteria. Pathogenicity and virulence factors.

34. Toxins of bacteria, their nature, properties, obtaining.

35. The role of Mechnikov in the formation of the immunity theory. Non-specific defense factors of the body.

35. Infection. Definition. Characteristics, driving forces of the infectious process. The role of the microorganism in the infectious process.

37. Infection. Pathogenicity and virulence. Environmental factors in the occurrence of an infectious process.

38. Infection. The role of the macroorganism in the infectious process.

39. Methods of microbial identification.

40. Bacterial cell structure. Characteristics of optional structures: spores, flagella, villi, inclusions. Plasmids. Capsules. Their identification and significance.

41. Morphology features and methods for detection of fungi, protozoa, spirochete, actinomycetes, rickettsia, chlamydia, mycoplasma, and viruses.

42. Types and mechanisms of bacterial nutrition. Cultivation of bacteria. Nutrient media. Isolation of a pure aerobic bacteria culture (1st stage).

43. Growth, reproduction and respiration of bacteria. Isolation of a pure aerobic bacteria culture (2nd stage). Methods for cultivation of anaerobic bacteria.

44. Bacterial enzymes. Isolation of a pure aerobic bacteria culture (3rd stage). Methods for studying of biochemical properties of a pure culture. Methods for isolating of a pure anaerobic culture.

45. Microflora of the environment (soil, water, air). Microbiological examination of water, air, soil: indicators, methods for their determination, standards.

46. The effect of physical, chemical and biological factors on microorganisms. Disinfection and disinfectants. The concept of aseptic, antiseptic, conservation.

47. Chemotherapy. Methods of obtaining, the spectrum and mechanism of action of antibiotics. Methods for determining the sensitivity of microorganisms to antibiotics (disc diffusion, serial dilutions and «grooves» method).

### **List of questions for the exam (5 semester):**

1. Methods of microbiological diagnosis of infectious diseases. Specific prevention and treatment.
2. Typhoid and paratyphoid fever causative agents. Taxonomy and characteristic. Microbiological diagnosis. Specific prevention and treatment.
3. Colibacillosis causative agent. Taxonomy. Characteristic. The role of *E. coli*



- in health state of the human body and during disease. Microbiological diagnosis of colibacillosis. Specific prevention and treatment.
4. Intestinal yersiniosis causative agent. Taxonomy. Characteristic. Microbiological diagnosis. Specific prevention and treatment.
  5. Shigellosis causative agent. Taxonomy. Characteristic. Microbiological diagnosis. Specific prevention and treatment.
  6. Salmonellosis causative agent. Classification by antigenic structure. Microbiological diagnosis of salmonellosis. Specific prevention and treatment.
  7. Cholera causative agent. Taxonomy. Characteristic. Microbiological diagnosis. Specific prevention and treatment.
  8. Staphylococcus. Taxonomy. Characteristic. Microbiological diagnosis of staphylococcal infections. Specific prevention and treatment.
  9. Streptococci. Taxonomy. Characteristic. Microbiological diagnosis of streptococcal infections. Specific prevention and treatment.
  10. Meningococci. Taxonomy. Characteristic. Microbiological diagnosis of meningococcal infections. Specific prevention and treatment.
  11. Gonococci. Taxonomy. Characteristic. Microbiological diagnosis of gonorrhoea. Specific prevention and treatment.
  12. Tularemia causative agent. Taxonomy and characteristic. Microbiological diagnosis. Specific prevention and treatment.
  13. Causative agent of anthrax. Taxonomy and characteristic. Microbiological diagnosis, prevention and treatment.
  14. Brucellosis causative agent. Taxonomy and characteristic. Microbiological diagnosis. Specific prevention and treatment.
  15. Plague causative agent. Taxonomy and characteristic. Microbiological diagnosis. Specific prevention and treatment.
  16. Features of microbiological diagnosis in quarantine infections. Express diagnostics.
  17. Causative agents of anaerobic gas infection. Taxonomy and characteristic. Microbiological diagnosis. Specific prevention and treatment.

18. Botulism causative agent. Taxonomy and characteristic. Microbiological diagnosis. Specific prevention and treatment.
19. Tetanus causative agent. Taxonomy and characteristic. Microbiological diagnosis. Treatment.
20. Diphtheria causative agent. Taxonomy and characteristic. Opportunistic Corynebacterium. Microbiological diagnosis. Specific prevention and treatment.
21. Pertussis causative agent. Taxonomy and characteristic. Microbiological diagnosis. Specific prevention and treatment.
22. Tuberculosis causative agent. Taxonomy and characteristic. Atypical Mycobacterium. Microbiological diagnosis. Specific prevention and treatment.
23. Chlamydia. Taxonomy and characteristic. Microbiological diagnosis. Treatment.
24. Syphilis causative agent. Taxonomy and characteristic. Microbiological diagnosis. Treatment.
25. Leptospirosis causative. Taxonomy and characteristic. Microbiological diagnosis. Specific prevention and treatment.
26. Clinical microbiology and its tasks. The role of opportunistic microorganisms in the intra-hospital infections.
27. Stages of virology development.
28. SARS causative agents. Taxonomy. Characteristic. Laboratory diagnosis. Specific prevention and treatment.
29. Influenza causative agent. Taxonomy. Characteristic. Laboratory diagnosis. Specific prevention and treatment.
30. Polio causative agents. Taxonomy and characteristic. Laboratory diagnosis. Specific prevention.
31. Hepatitis A and E causative agent. Taxonomy. Characteristic. Laboratory diagnosis. Specific prevention.
32. Tick-borne encephalitis causative agent. Taxonomy. Characteristic. Laboratory diagnosis. Specific prevention.

33. Rabies pathogen. Taxonomy. Characteristic. Laboratory diagnosis. Specific prevention.
34. Rubella causative agent. Taxonomy. Characteristic. Laboratory diagnosis. Specific prevention.
35. Measles virus. Taxonomy. Characteristic. Laboratory diagnosis. Specific prevention.
36. Herpes infection. Taxonomy. Characteristic. Laboratory diagnosis. Specific prevention and treatment.
37. Hepatitis B, C, D. causative agents. Taxonomy. Characteristic. Carrier. Laboratory diagnosis. Specific prevention.
38. HIV infection. Taxonomy, characterization of pathogens. Laboratory diagnosis. Specific prevention.
39. Classification and characterization of oncogenic viruses.
40. Characteristics of campylobacteriosis and helicobacteriosis causative agents. Principles of laboratory diagnosis. Treatment, specific and non-specific prophylaxis.
41. Characteristics of listeriosis causative agent. Principles of laboratory diagnosis. Treatment, specific and non-specific prophylaxis.
42. Characteristics of rickettsiosis pathogens. Principles of laboratory diagnosis. Treatment, specific and non-specific prophylaxis.
43. Characteristics of the toxoplasmosis causative agent. Principles of laboratory diagnosis. Treatment, specific and non-specific prophylaxis.
44. Characteristics of the amebiasis and giardiasis causative agents. Principles of laboratory diagnosis. Treatment, specific and non-specific prophylaxis.
45. Characteristics of fungal infection causative agents. Principles of laboratory diagnosis. Treatment, specific and non-specific prophylaxis.
46. Characteristics of protozoal infections causative agents. Principles of laboratory diagnosis. Treatment, specific and non-specific prophylaxis.
47. Characteristics of enteroviruses, ECHO viruses, Coxsackie A and B viruses. Principles of laboratory diagnosis. Treatment, specific and non-specific

prophylaxis.

**Criteria for students grading on the exam/test  
on the discipline "Microbiology, virology"**

<b>Exam grade</b>	<b>Requirements for the formed competencies</b>
«excellent»	The grade “excellent” should be given to the student, if he has deeply and firmly mastered the program material, exhaustively, consistently, clearly and logically presents it, knows how to closely link theory with practice, freely copes with tasks, questions and other types of knowledge, uses the material of monographic literature during the answer, correctly substantiates the decision made, has various skills and techniques for performing practical tasks;
«good»	The grade “good” should be given to the student, if he knows the material firmly, correctly and essentially sets it out, avoiding significant inaccuracies in answering the question, correctly applies theoretical principles in solving practical questions and problems, has the necessary skills and techniques for their implementation;
«satisfactorily»	The grade “satisfactory” should be given to the student, if he has knowledge of only basic material without details, admits inaccuracies, insufficiently correct formulations, violations of the logical sequence in the presentation of the program material, has difficulties in performing practical work;
«unsatisfactory»	The grade “unsatisfactory” should be given to the student who does not know a significant part of the program material, makes significant mistakes, and has difficulties in doing practical work.

**Evaluation tools for current certification**

Control tests are designed for students studying the course "Microbiology and Virology."

When working with tests, it is offered to choose one answer from three to four proposed. At the same time, tests are unequal in complexity. Among the proposed tests there are ones that contain several options for correct answers. The student must specify all the correct answers.

Tests are designed for both individual and collective solutions. They can be used both in the process of independent and in classroom work.

The results of the test are assessed by the teacher on a five-point scale for is-

suing attestation or according to the system “test” - “no test”. Оценка «отлично» выставляется при правильном ответе на более чем 90% предложенных преподавателем тестов. The grade "excellent" is set with the correct answers of more than 90% of the tests proposed by the teacher. The grade «good» – with the right answer to more than 70% of tests. The grade «satisfactory» – with the correct answer to 50% of the proposed tests.

## **Evaluation tools for current certification**

### **Questions for test control**

#### **Section 1. General microbiology, virology**

Choose the correct answer:

1. Which microbiology laboratory relates to a general-purpose laboratory?
  - a) bacteriological
  - b) virological
  - c) mycological
  - d) parasitological
2. What method is used to detect volutin grains in bacteria?
  - a) Gram staining
  - b) Neisser staining
  - c) Ozheshko staining
3. What should you need to do immediately, if you poured a tube with culture?
  - a) clean up immediately, wash with hot water
  - b) fill with disinfection solution for 30-60 minutes
  - c) sweep the broom into the scoop
  - d) after 60 minutes of disinfection kill in an autoclave
4. Which fixation method suites for the blood smear?
  - a) heat
  - b) chemical fixer
5. Which fixation method suites for the dense material smear (for example feces)?

- a) heat
  - b) 60% ethanol
  - c) ether
6. Which fixation method suits for the pure microbial culture smear?
- a) heat
  - b) 60% ethanol
  - c) ether
7. What simple coloring methods and dyes are used according to Löffler?
- a) Romanovsky-Giemsa stain
  - b) methylene blue solution
  - c) divorced basic fuchsine
  - d) manganic acid potassium
  - e) iodine
8. What is the purpose of smear fixation?
- a) attachment of bacteria to the glass
  - b) microbial inactivation
  - c) for the save working process
  - d) improvement of perception of the dye by the microbe
  - e) all of the above
  - f) volutin grains
9. What bacteria have many flagella all over the cell surface?
- a) monotrichas
  - b) amphitrihas
  - c) lofotrachs
  - d) peritrich
10. What bacteria have one flagella or a bundle of flagella at both ends of the cell?
- a) monotrichas
  - b) amphitrihas
  - c) lofotrachs
  - d) peritrich

11. What bacteria have one flagellum at the end of the cell?
- a) monotrichas
  - b) amphitrihas
  - c) lofotrichs
  - d) peritrich
12. Sporulation in bacteria:
- a) is a reproduction method
  - b) contributes to the preservation of the bacteria
13. Specify the direct method for determining the bacterial motility:
- a) flagella detection by the Morozov, Leffler method
  - b) cultivation on meat-and-peptone agar media
  - c) agglutination test
14. Specify the differentiation component for Gram staining:
- a) gentian violet
  - b) fuchsine
  - c) iodine solution
  - d) water
  - e) alcohol
15. Gram-negative bacteria stained in blue during Gram staining. Possible reason of mistake:
- a) smear not treated with iodine solution
  - b) smear discolored with alcohol too much
  - c) smear is not discolored enough with alcohol
  - d) smear not stained with fuchsine
16. For the detection of acid-resistant bacteria ... staining is used:
- a) Burri
  - b) Gram
  - c) Ziehl-Nielsen
  - d) Neisser
  - e) Ozheshko

17. Which bacteria have two forms of existence — stage of the elementary body outside the cell and stage reticular body inside the cell?
- a) spirochetes
  - b) chlamydia
  - c) mycoplasma
  - d) protozoa
18. Protozoan trophozooids stained:
- a) with iodine solution
  - b) according to Romanovsky-Giemsa
19. What are endospores for fungi?
- a) reproductive organs
  - b) protection organelles
  - c) respiratory system
20. Simple nutrient medium
- a) meat-and-peptone agar
  - b) Endo
  - c) Egg-yolk Salt Agar
21. Differential nutrient medium
- a) meat-and-peptone agar
  - b) Endo
  - c) Kitt-Tarozzi
22. At what value of the chemotherapeutic index (CTI) drug is considered effective:
- a)  $CTI > 3$
  - b)  $CTI < 1$
  - c)  $CTI = 1$
23. Prophage is a:
- a) precursor phage particle at the assembly stage
  - b) moderate phage nucleic acid inserted into bacterial DNA
  - c) virulent phage nucleic acid in the cytoplasm



24. In the studied material it is possible to determine the presence of phage particles (virions) by methods:
- a) Grace
  - b) Otto
  - c) Appelman
  - d) all of the above
25. Bacteriophage titer is:
- a) the maximum dilution of the studied material filtrate, in which at least one phage particle is detected
  - b) the number of phage particles per unit of volume of the test material
  - c) maximum dilution or minimum amount of phage giving lysis of bacteria
26. The reaction of the increase of the titer of phage (RITF) allows determine:
- a) presence of the pathogen in the test material
  - b) bacteriophage titer
  - c) stage of the infectious process
27. What is used for an unknown phage identification?
- a) test culture
  - b) substrate (filtrate) with phage
  - c) medium – solid or liquid
  - d) all of the above
  - e) dissociation
  - f) transformation
28. Which of the following enzymes is not pathogenic
- a) hyaluronidase
  - b) fibrinolysin
  - c) hemolysin
  - d) plasma coagulase
29. Which of the following vaccines is alive:
- a) against hepatitis B
  - b) DTP

c) plague

30. Which of the following vaccines is inactivated:

a) typhous

b) measles

c) brucellosis

### **Testing evaluation criteria**

Evaluation is carried out in an e-learning session on a 100-point scale. The test includes 100 tasks, the maximum test score is 100. In the framework of the current level of mastering knowledge in a discipline, a test result of at least 61 points is allowed.

### **Examples of situational tasks**

1. Laboratory received the sputum of the patient with a pathological process in the lungs. Outline a laboratory research plan.
2. A patient with an injury of the right leg was admitted to the surgical department. The soft tissues of the lower leg are smashed and polluted with earth. Make a plan of bacteriological laboratory examination of the patient, a plan of preventive and therapeutic measures.
3. A patient with a botulism was admitted to the hospital. Emetic masses and canned remains (the supposed source of infection) were delivered to the laboratory. Make a plan of laboratory research, a plan of anti-epidemic, therapeutic and preventive measures.
4. A series of purulent postoperative complications appeared in the hospital of the surgical clinic. Outline a plan for identifying the source of the infection, isolating the pathogen and associating the pathogen with the source of infection.
5. The lid on the jar with harvested mushrooms swelled. Outline a plan of the causative agent of the product damage detection and its fate.
6. The microbial number in the well water sample is 15 mt/ml, the coli index is 2, but the El Tor vibrio was detected. Give a conclusion about the suitability of water in this source.
7. The coli titer of water in an open reservoir is 550 ml, the typhoid bacteriophage

is isolated from it in a high titer. Is this water suitable for drinking?

**Evaluation criteria for solving situational problems:**

- the grade “excellent” is given to the student who correctly solved the problem and justified his decision, gave a reference to the normative document required for the decision;
- the grade “good” is deserved by the student who correctly solved the problem but did not justify his decision at the proper level;
- the “satisfactory” grade is deserved by a student who has discovered a sufficient level of knowledge to solve a problem, but has allowed errors;
- the grade "unsatisfactory" is given to the student who did not solve the problem.

**Example of the control test**

1. Specific prevention of gonorrhoea include:

- A. Auto vaccine
- B. Antitoxic serum
- C. Specific gamma globulin
- D. Anatoxin
- E. No specific prevention

2. For the specific prevention of whooping cough ... is applied:

- A. inactivated vaccine
- B. bacteriophage
- C. antibiotics
- D. live vaccine
- E. anatoxin

3. Preparation of salmonella monoreceptor serums based on:

- A. Hyperimmunization of horses
- B. Immunization of mice
- C. Castellani depletion of immune serum
- D. Titration in the flocculation reaction
- E. Treatment of immune serum by dialysis and enzymatic hydrolysis

4. For the tetanus treatment ... is/are used:

- A. Bacteriophages
- B. Interferon
- C. Antimicrobial serum
- D. Antitoxic serum
- E. Anatoxin

5. For the botulism treatment ... is/are used:

- A. Antimicrobial serum
- B. Polyvalent antitoxic serum
- C. Autovaccine
- D. Anatoxin
- E. Bacteriophages

6. Plague bacteria are characterized by:

- A. Spherical shape
- B. Ovoid shape
- C. Motility
- D. Gram positive coloration
- E. Spore formation

7. For the specific prevention of diphtheria ... is/are used:

- A. Live vaccine
- B. Inactivated vaccine
- C. Chemical vaccine
- D. Anatoxin
- E. Antimicrobial serum

8. Specific therapy for diphtheria is held with:

- A. Anatoxin
- B. Antitoxic serum
- C. Bacteriophage
- D. Antibiotics
- E. Exotoxin

9. *Mycobacterium tuberculosis* is cultivated on:

- A. Egg-yolk Salt Agar
- B. Löffler medium
- C. Levenshtein-Jensen medium
- D. Blood agar
- E. Wilson-Blair medium

10. Laboratory diagnosis of primary syphilis include:

- A. Immobilization reaction
- B. Direct microscopy
- C. Wasserman reaction
- D. Reaction of indirect hemagglutination
- E. Precipitation reaction

11. What disease is caused by Provachek rickettsia?

- A. Epidemic relapsing typhus
- B. Endemic typhus
- C. Ku fever
- D. Endemic relapsing typhus
- E. Epidemic typhus

12. The source of epidemic typhus infection is:

- A. Cootie
- B. Rodents
- C. Sick person
- D. Small cattle
- E. Cattle

13. Mycoses most common in children under 6 months:

- A. Epidermofitiya
- B. Favus
- C. Candidiasis
- D. Actinomycosis
- E. Trichophytosis

14. The basic properties of viruses:

- A. Sporulation
- B. Ability to divide
- C. Disjunctive reproduction
- D. Cell structure
- E. Content of various nucleic acids

15. Virion is a:

- A. Separate cell
- B. Accumulation of viruses
- C. Pure virus culture
- D. Separate virus particle
- E. Intracellular incorporation

16. The viral envelope consists predominantly from:

- A. Mycolic acid
- B. Nucleic acid
- C. Polysaccharides
- D. Proteins
- E. Glucid-lipid-proteid complex

17. Intracellular inclusions have diagnostic value at:

- A. Typhoid fever
- B. Rabies
- C. Sape
- D. Poliomyelitis
- E. Tick-borne encephalitis

18. Viruses are cultivated:

- A. On a media with the addition of native protein
- B. In the developing chicken embryo
- C. On the Levenshteyna-Jensen media
- D. On the Egg-yolk Salt Agar
- E. On synthetic nutrient media

19. Cell sensitivity to viruses is determined by the presence of:

- A. Cellular receptors
- B. Cytoplasmic membrane
- C. Peptidoglycan
- D. Mitochondria
- E. Lysosome

20. Features of antiviral immunity:

- A. The predominance of delayed-type hypersensitivity
- B. Predominance of cellular defense mechanisms
- C. Completion of the phagocytic reaction
- D. Formation of inflammation at the entrance gate
- E. Interferon synthesis

21. Flu epidemiology is characterized by:

- A. Vertical transmission path
- B. Transmissible transmission path
- C. Sporadic diseases
- D. Emergence of epidemics and pandemics
- E. Water transmission path

22. Hemocontact route of transmission is characteristic for:

- A. Hepatitis B
- B. Hepatitis E
- C. Encephalitis
- D. Poliomyelitis
- E. Hepatitis A

**Evaluation criteria for the control test:**

**91-100 points** (excellent) are given to the student, in the case of not less than 90% of correct answers, if the tasks are correctly solved and justified, the exact definitions of terms are given;

**75-90 points** (good) are given to the student if the correct answers are given for 75-90% of test tasks, the tasks are correctly solved and justified, the exact defi-

nitions of terms are given or the correct answers are given for at least 90% of test tasks, there are errors in solving problems, incomplete definitions of terms;

**61-74 points** (satisfactory) are given to the student, if the correct answers are given to 61-74% of test questions, there are errors in solving and justifying problems, incomplete definitions of terms are given;

**60 and less points** (unsatisfactory) are given to the student if the correct answers are given for 60% or less of test tasks and/or problems are not solved, definitions are not given.

**Example of the Lesson № 1 on the topic: MICROSCOPIC METHODS OF BACTERIAL MORPHOLOGY STUDING (4 semester)**

**OBJECTIVES:** To study the rules of work in the microbiological laboratory. Master the methods of preparation and microscopic examination of stained preparations.

**PLAN OF ACTIVITIES:**

**I. ISSUES FOR DISCUSSION:**

1. Morphology and classification of bacteria.
2. Modern methods of microscopic research.
3. Rules of the microscopy with an immersion lens.
4. Rules for the preparation of slides of microbial cultures from liquid and solid nutrient media.
5. Simple microbial staining methods.

**II. DEMONSTRATION:**

1. Microscopes: light, binocular.
2. *Neisseria gonorrhoeae* in a pus (methylene blue staining).
3. Sarcina cells smear (methylene blue staining).
4. Experiment on identification of the difference in the refractive indices of glass, air, water, cedar oil
5. Smear of *Streptococcus pyogenes* (gentian violet staining).

**III. GUIDELINES:**



1. Show the rules of working with an immersion lens and a structure of microscope: a flat mirror, an open diaphragm, a raised condenser, an immersion lens.
2. Show the stages of slides with microbial cultures from solid and liquid nutrient media preparation.
3. Pay attention to the procedure of protocols filling.
4. To acquaint students with the rules of safety when working in the bacteriological laboratory.

#### **IV. PRACTICAL WORK OF STUDENTS:**

1. Preparation of smears with *Escherichia coli* liquid medium culture (aqueous fuchsin staining).
2. Preparation of smears with *Staphylococcus saprophyticus* solid medium culture (gentian violet staining).
3. Microscopy and sketching of stained smears.
4. Protocol filling.

#### **V. EQUIPMENT:**

1. Microscopes: light, binocular.
2. Broth culture *E.coli*.
3. Staphylococcus culture on solid agar.
4. Glassware: slides, tubes with a saline, wash bottles.
5. Bacteriological loops.
6. Gram staining kit.

#### **VI. TABLES:**

1. The comparative size of microorganisms
2. The main shapes of bacteria
3. Spiral shapes of bacteria
4. Round shapes of bacteria
5. Slides preparation
6. The course of rays in a dark-field microscope.

**Example of the Lesson №9 on the topic: DIPHTHERIA AND PERTUSSIS**

## CAUSATIVE AGENTS (5 semester).

**OBJECTIVES:** To study the biological properties of causative agents of diphtheria and pertussis, microbiological diagnostics and prevention of infections caused by them.

### PLAN OF ACTIVITIES:

#### I. ISSUES FOR DISCUSSION:

1. Characteristics of the diphtheria causative agent.
2. Diphtheria source of infection, ways of transmission, pathogenesis.
3. The main clinical forms of diphtheria.
4. Microbiological diagnosis of diphtheria.
5. Specific prophylaxis and serotherapy for diphtheria.
6. Characteristics of the pertussis causative agent.
7. Pertussis source of infection, ways of transmission, pathogenesis.
8. Clinical manifestations of pertussis.
9. Specific prevention of pertussis.
10. Characteristics of the causative agent of hemophilic infection. Manifestations of infection.

#### II. DEMONSTRATION:

1. *Corynebacterium diphtheriae* growth on Clauberg medium.
2. Short motley rows with diphtheria and false diphtheria cells.
3. Test for cystinase and test for urease with diphtheria, false diphtheria bacteria and diphtheroids.
4. Determination of toxigenicity of diphtheria cultures by gel precipitation method.
5. Model - throat diphtheria.
6. Swab for taking mucus from the larynx and nasopharynx of children.
7. Borde - Zhang reaction
8. Slides with *Corynebacterium diphtheriae* (Leffler staining) and *Bordetella pertussis* (Gram staining).
9. Vaccines: pertussis, DTP, ADS-M, diphtheria-tetanus, diphtheria toxoid.
10. Anti-diphtheria serum.

### **III. PRACTICAL WORK OF STUDENTS:**

1. Staining and bacterioscopy of *Bordetella pertussis* smears (Gram staining).
2. Staining and bacterioscopy of *Corynebacterium diphtheriae* smears (Gram, Leffler staining).
3. Examination of students for carriage of diphtheria: inoculation of mucus from the throat on the Leffler medium.
4. Filling the protocol.

### **IV. EQUIPMENT:**

1. Sterile cotton swabs.
2. Löffler medium.
3. Gram staining kit, methylene blue.
4. Biological microscopes

### **V. TABLES:**

1. *Cornynebacterium diphtheriae*
2. Colonies of diphtheria
3. Method for the determination of the diphtheria bacteria toxicity in agar gel
4. Pharynx diphtheria
5. Localized pharynx diphtheria
6. Diphtheria of nose, eyes, skin and toxic form
7. Pertussis
8. Microbiological diagnostics of pertussis
9. Microbiological diagnostic methods