

MINISTRY OF EDUCATION AND SCIENCE OF THE RUSSIAN FEDERATION

PENZA STATE UNIVERSITY

MEDICAL INSTITUTE



AGREED:

Director of the Medical Institute

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**STUDY PROGRAMME**

**C1.1.19 Microbiology, Virology**

**Course** – 31.05.01. General Medicine

**Graduate's Degree** – Medical doctor

**Type of study** – full-time

## 1. Aims and goals

The purpose of the mastering of the discipline "Microbiology, Virology" is to study classification, morphology and physiology of microorganisms and viruses, and their impact on public health, microbiological diagnostic methods; application of the main antibacterial, antiviral and biologicals.

The purposes of the study of microbiology, virology students include:

- understanding of the morphology and physiology of microorganisms;
- formation of ideas about the role of microorganisms in the etiology and pathogenesis of infectious diseases;
- study of the major clinical manifestations and prevalence of diseases caused;
- development of specific methods of diagnosis, prevention and treatment of infectious diseases.

## 2. Links to other disciplines of the general curriculum

Academic discipline «Microbiology, Virology» refers to basic part of the unit C1. Disciplines. «Microbiology, virology» based on the knowledge obtained during the course of studying biology, chemistry, and biochemistry. Competencies acquired during the study of microbiology, virology prepares students for the development of professional competencies.

Main provisions of discipline should be used for further study of clinical disciplines («Epidemiology», «Infectious diseases», «Dermatovenereology» and «Phthisiology»).

## 3. Student competences, developed during learning "Microbiology, Virology"

According to the state curriculum for the course, learning is oriented at developing the following competences and their elements:

Competence code	Name of the competence	Structural elements of competence (knowledge, skill, application as a final learner outcome)
1	2	3
GEC-1	abstract thinking, logical analysis and synthesis skills	Knowledge: classification, morphology and physiology of microorganisms and viruses, and their impact on public health, microbiological diagnostic methods; application of the main antibacterial, antiviral and biological.
		Skills: analyze the scientific problem arising in professional activities
		Working abilities: the skills to use in practice methods of Biomedical Sciences
SPC-1	be able to perform the scope of measures aimed at protecting and promoting the health and safety of the public, including fostering healthy lifestyle, prevention of the diseases and their treatment, early diagnostic of medical conditions, their causes and conditions of their development, elimination of harmful environmental factors	Knowledge: classification, morphology and physiology of microorganisms and viruses, and their impact on public health; methods for prevention of infectious diseases.
		Skills: work with magnifying equipment (microscopes); use this knowledge to effectively treat infectious and opportunistic diseases; conduct taking material for bacteriological and virological investigations

		Working abilities: skills sterilization, disinfection and antiseptics tools and equipment in order to avoid infection of doctor and patient.
SPC-2	be ready to perform prophylactic medical check-ups, public health examination and health surveys	<p>Knowledge: classification, morphology and physiology of microorganisms and viruses, and their impact on public health, microbiological diagnostic methods; application of the main antibacterial, antiviral and biological.</p> <p>Skills: use this knowledge to effectively treat infectious and opportunistic diseases; conduct taking material for bacteriological and virological investigations.</p> <p>Working abilities: posing preliminary diagnosis based on the results of laboratory examination of the population.</p>
SPC-5	be able to analyse patients complaints and medical history, results of medical examinations, laboratory tests, special equipment diagnostics and others so as to determine the presence or absence of pathologies, medical disorders and diseases	<p>Knowledge: safety rules and work in microbiological laboratories; microbiological diagnostic methods</p> <p>Skills: work with magnifying equipment (microscopes); use this knowledge to effectively treat infectious and opportunistic diseases; conduct taking material for bacteriological and virological investigations</p> <p>Working abilities: skills sterilization, disinfection and antiseptics tools and equipment in order to avoid infection of doctor and patient; posing preliminary diagnosis based on the results of laboratory examination of the population.</p>
SPC-6	be able to determine the pathological states and conditions, symptoms and syndromes, nosology forms according to the International Classification of Diseases (N revision)	<p>Knowledge: pathogenesis and clinical picture of various infections.</p> <p>Skills: work with magnifying equipment (microscopes); use this knowledge to recognize nosological forms of infectious diseases.</p> <p>Working abilities: skills of detection nosological forms of infectious diseases.</p>

#### 4. Structure and content of the discipline of microbiology, virology

##### 4.1. The structure of the discipline

Overall workload equals 7,0 ECTSs, 252 hours.

№ π/π	Names of parts and topics of the discipline	semester	weeks of the semester	Kinds of study, including independent work of students and labor (hours)									Form ongoing monitoring of progress (by week of the semester)							
				Class work				Individual work					The interview	The Colloquium	check the test	Verifying work	checking abstract	Checking essays and other creative works	Course work (project)	Etc.
				Total	The lecture	practical exercises	Laboratory studies	Total	Preparing for classroom work	Essay, essays, etc.	Course work (project)	Exam Preparation								
<b>1.</b>	<b>Section 1. Morphology, physiology and ecology of microorganisms</b>	4	1-10	52	12	40		21	12				1-9	10	2-9					2-9
1.1.	Subject, tasks, and the history of microbiology. Microbiology laboratory and workplace equipment.	4	1	6	2	4		2	2				1							
1.2.	Morphology of bacteria. The structure of the bacterial cell.	4	2	6	2	4		2	2				2		2					2
1.3.	Bacteriological method of diagnosis. Food bacteria. nutrient media	4	3	4	-	4		2	2				3		3					3
1.4.	The biochemical properties of the microorganisms.	4	4	6	2	4		2	2				4		4					4
1.5.	Breathing organisms. Anaerobes.	4	5	6	2	4		2	2				5		5					5
1.6.	Antagonism germs and antibiotics	4	6	4	-	4		2	2				6		6					6
1.7.	Bacteriophages. Genetics of Microorganisms.	4	7	6	2	4		2	2				7		7					7

1.8.	Normal microflora of the human body.	4	8	4	-	4		2	2				8		8				8
1.9.	Ecology of microorganisms. Fundamentals of health microbiology	4	9	6	2	4		2	2				9		9				9
1.10	The Colloquium number 1. Morphology, physiology and ecology of microorganisms	4	10	4	-	4		3	3					10					
<b>2.</b>	<b>Section 2. The causative agents of bacterial infections</b>	4	11-19	43	7	36		28	19		9		11-18	19	11-18				11-18
2.1.	Microbiological diagnosis of bacterial intestinal infections: ehsherihiosis, shigellosis, yersiniosis.	4	11	6	2	4		2	2				11		11				11
2.2.	Microbiological diagnosis of bacterial intestinal infections: typhoid, paratyphoid, salmonellosis.	4	12	4	-	4		2	2				12		12				12
2.3.	Microbiological diagnosis of cholera. Food poisoning is a bacterial etiology. Campylobacteriosis.	4	13	4	-	4		2	2				13		13				13
2.4.	Purulent septic infections. Laboratory diagnosis of PSI caused by anaerobic and facultative anaerobic bacteria.	4	14	4	-	4		2	2				14		14				14
2.5.	Purulent septic infections. Activators of anaerobic infections. Prevention of PSI.	4	15	4	-	4		2	2				15		15				15
2.6.	Airborne infection.	4	16	6	2	4		5	2		3		16		16				16
2.7.	Laboratory diagnosis of sexually transmitted diseases	4	17	4	-	4		5	2		3		17		17				17
2.8.	Causative agents of zoonotic infections.	4	18	7	3	4		5	2		3		18		18				18
2.9.	The Colloquium number 2. Causative agents of bacterial infections	4	19	4	-	4		3	3					19					
<b>3.</b>	<b>Section 3. Special microbiology.</b>	5	1-8	22	6	16		6	6				1-6	7-8	1-6				5-6
3.1.	Pathogenic spirochetes: Treponema, Borrelia, Leptospira.	5	1	2	-	2		0,5	0,5				1		1				
3.2.	Microbiological diagnosis of	5	2	2	-	2		0,5	0,5				2		2				

	chlamydia, mycoplasmosis.																		
3.3.	Microbiological diagnosis of rickettsial diseases.	5	3	4	2	2		0,5	0,5				3		3				
3.4.	Pathogens protozoal infections.	5	4	2	-	2		0,5	0,5				4		4				
3.5.	Pathogenic fungi. Features of biology.	5	5	4	2	2		0,5	0,5				5		5				5
3.6.	Causative agents of fungal infections and candidiasis.	5	6	2	-	2		0,5	0,5				6		6				6
3.7.	The Colloquium number 3. Special microbiology	5	7-8	4	-	4		3	3					7-8					
<b>4.</b>	<b>Section 4. General and special virology</b>	5	9-19	35	13	22		9	9				9-17	18-19	9-17				
4.1.	General Virology. The structure and characteristics of viruses	5	9	5	3	2		1	1				9		9				
4.2.	Cultivation techniques and display viruses.	5	10	2	-	2		0,5	0,5				10		10				
4.3.	Causative agents of acute respiratory viral infections	5	11	4	2	2		1	1				11		11				
4.4.	Causative agents of acute respiratory viral infections. Influenza.	5	12	2	-	2		0,5	0,5				12		12				
4.5.	Enteroviruses.	5	13	4	2	2		0,5	0,5				13		13				
4.6.	Causative agents of viral hepatitis.	5	14	4	2	2		1	1				14		14				
4.7.	Causative agents of dangerous viral infections.	5	15	4	2	2		0,5	0,5				15		15				
4.8.	Human immunodeficiency virus (HIV)	5	16	4	2	2		0,5	0,5				16		16				
4.9.	Herpesviruses	5	17	4	2	2		0,5	0,5				17		17				
4.10	The Colloquium number 4. General and special virology.	5	18-19	4	-	4		3	3					18-19					
	Course work (project)	4						12				9							
	<i>Exam Preparation</i>	5											36						
	Overall workload, in hours			152	38	114		100	55			9	36	interim certification					
														form	semester				
														Offset	-				
														The exam	5				

## **4.2 Content of discipline "Microbiology, Virology"**

### **INTRODUCTION**

Life as we know it would not exist without microorganisms. Plants depend on microorganisms to help them obtain the nitrogen they need for survival. Animals such as cows and sheep need microbes in order to digest the many carbohydrates in their plant-based diets. Ecosystems rely on microorganisms to enrich soil, degrade wastes, and support life. We use microorganisms to make wine and cheese and to develop vaccines and antibiotics. The human body is home to trillions of microorganisms, many of which help keep us healthy. Microorganisms are an essential part of our lives.

Of course, some microorganisms do cause harm to us, from the common cold to more serious diseases such as tuberculosis, malaria, and AIDS. The threats of bioterrorism and new or reemerging infectious diseases are real. This textbook explores all the roles—both harmful and beneficial—that microorganisms play in our lives, as well as their sophisticated structures and processes. We begin with a look at the history of microbiology, starting with the invention of crude microscopes that revealed, for the first time, the existence of this miraculous, miniature world.

### **1. Microbiology**

#### **1.1. History of microbiology**

The science of medical microbiology dates back to the pioneering studies of Pasteur and Koch, who isolated specific agents and proved that they could cause disease by introducing the experimental method. The methods they developed led to the first golden age of microbiology (1875–1910), when many bacterial diseases and the organisms responsible for them were defined. These efforts, combined with work begun by Semmelweis and Lister, which showed how these diseases spread, led to the great advances in public health that initiated the decline in disease and death. In the first half of the 20th century, scientists studied the structure, physiology, and genetics of microbes in detail and began to answer questions relating to the links between specific microbial properties and disease.

By the end of the 20th century, the sciences of molecular biology, genetics, genomics, and proteomics extended these insights to the molecular level. Genetic advances have reached the point where it is possible to know not only the genes involved but understand how they are regulated. The discoveries of penicillin by Fleming in 1929 and of sulfonamides by Domagk in 1935 opened the way to great developments in chemotherapy. These gradually extended from bacterial diseases to fungal, parasitic, and finally viral infections. Almost as quickly, virtually all categories of infectious agents developed resistance to all categories of antimicrobics to counter these chemotherapeutic agents.

#### **1.2. Communication of microbiology with other disciplines.**

The subfields or branches of microbiology are diverse and many. Microbiology can be classified into pure and applied sciences. Microbiology can be also classified based on taxonomy, in the cases of bacteriology, mycology, protozoology, and phycology. There is considerable overlap between the specific branches of microbiology with each other and with other disciplines.

The science of microbiology is relatively young and it offers practical applications for different areas of human activity: medicine, agriculture, nutrition, biotechnology and more. Theoretical and practical accumulation of nuclear physics, cellular and molecular biology, and information techniques have led to the improvement of microbiology logistics, resulting in the rapid development of microbiology as a multilateral science. Studying microbiology touches upon elements of other disciplines like chemistry, biomedicine, public health, environmental impacts and human health.

Two main branches of microbiology are bacteriology and virology (which deals with the study of viruses and diseases), while other sub-disciplines include: immunology, biotechnology, industrial microbiology, public health microbiology, environment microbiology and genetic engineering one of the most dynamic fields of modern microbiology.

# GENERAL MICROBIOLOGY

## 2. GENERAL BACTERIOLOGY, MYCOLOGY, PROTOZOOLOGY, VIROLOGY

### 2.1. Microbes systematic

Microbes systematic position in the living world. Prokaryotes (bacteria), they differ from microbial eukaryotes (protists, fungi) on the structure, chemical composition and functions. Acellular form (viruses, viroids, prions). Modern approaches to the taxonomy of microorganisms. Taxonomic categories: kingdom, order, family, genus, species. Intraspecific categories: biovar, serovar, fagovar, morfovar, cultivar. Population, culture, strain, clone. The definition used in the theoretical and Applied Microbiology. Binary nomenclature of bacteria. Modern classification of bacteria: archaeobacteria, eubacteria, proteobacteria. Classification of fungi. Classification of protozoa. Classification of viruses and human viruses, animals, plants, bacteria. Principles of classification of human viruses (family, genus, species).

### 2.2. Morphology of bacteria

#### 2.2.1. Morphology of bacteria.

Basic forms of bacteria (cocci, rod-shaped, convoluted, branching), size of the bacterial cells. Permanent and non-permanent structure of the bacterial cell : the nucleoid , cytoplasm , ribosomes , cytoplasmic membrane, mesosomy, inclusion , periplasm , cell wall ; capsule , the villi (pili) , flagella . The chemical composition and the functional value of individual structural components. Differences in the structure of the Gram-positive and Gram-negative bacteria. Protoplasts, Spheroplasts and L- forms of bacteria. Available actinomycetes, spirochetes, mycoplasma.

Basic methods of study of the morphology of bacteria: light microscopy with oil immersion lens, dark-field, phase contrast, fluorescent and electron - microscopic methods. Preparation of microscopic preparations. Simple and complex staining techniques. Gram, Ziehl -Nielsen, Orszekowa Neisser, Burri - Hins, Romanovsky - Giemsa. Their mechanisms.

#### 2.2.2. The morphology of fungi.

Basic forms of fungi (ovoid, micellar). Dimorphic fungi. Structure of fungi. Features of the structure of the cytoplasmic membrane and cell wall. Sporulation. Fungal spores (vegetative, endospores exospores, sex). Methods for studying the morphology of fungi (microscopy of native and stained preparations).

#### 2.2.3. Morphology of the simplest.

Human pathogenic protozoa, structural features, mobility, development cycles. Staining techniques to identify trophozoites, cysts and other forms of protozoa.

#### 2.2.4. Morphology of virus.

Principles of the structural organization of viruses. Concept of simple and complex viruses. The virion and its components. Nucleic acid capsid capsomers, core, superkapsidnaya shell. Types of symmetry of the nucleocapsid.

The shape and size of viruses.

Viruses bacteria (bacteriophages), their structure, morphological types. Electron microscopic study of viruses methods.

### 2.3. Microbial physiology

#### 2.3.1. Physiology of bacteria.

Features of bacterial metabolism: metabolic rate, a variety of types of metabolism, metabolic plasticity. Role bacteria in the cycle of matter in nature.

Constructive metabolism.

Food bacteria. Classification by type of food bacteria. The notion of autotrophs, heterotrophs, saprophytes, absolute and facultative parasites, prototrophy, auxotrophs . Requirements mye → to medium. Classification of nutrient media: regular, special, differential diagnosis, elective. Cure the → whether to create a culture media.

Transport of substances into the bacterial cell: volatile (simple and facilitated diffusion), volatile (active, translocation radicals).

Features of biosynthesis of proteins, nucleic acids, carbohydrates, lipids whether  $\neg$  bacterial cell.

Bacterial enzymes. Classes of enzymes. Exo- and endofermenty, their importance in the metabolism of cells. Constitutive and inducible enzymes.

Methods of study of the enzymatic activity of bacteria and its use for identification of bacteria.

Catabolic metabolism. Classification of bacteria according to the methods of obtaining energy. The concept of the phototrophic, hemolito and hemoorganotrofah.

Types of metabolism and methods of obtaining energy from geterohemoorganotrofov.

Oxidative metabolism. Oxygen breathing as a way to semition of energy.

Rotting - oxidative cleavage of proteins. Meaning rotting in the cycle of matter in nature and medicine.

Fermentative metabolism. Fermentation as a way to generate energy. Fermentation products. Their use in the diagnosis and biotehnologiches FIR processes.

Nitrate respiration - an example of anaerobic respiration. The relationship of the bacteria with oxygen. Strict anaerobes, microaerophiles, facultative anaerobes, strict aerobes aerotolerant bacteria: the protective system from the toxic effects of free oxygen radicals, methods of cultivation.

Growth and reproduction of bacteria. The mechanism and rate of microbial growth in a liquid medium in stationary conditions.

Periodic and continuous cultivation .Effect of temperature on the reproduction of bacteria: the concept of mesophiles, thermophiles, psychrophiles.

Colonies, especially their formation in different species of bacteria. Pigments bacteria.

Features of reproduction chlamydia, spirochetes, actinomycetes.

Principles and methods for the isolation of pure cultures of aerobic and anaerobic bacteria.

Stages of isolating pure cultures of bacteria and their identification. Intraspecies bacterial identification. The concept of the serovar morfovare, biovar, fagovare.

2.3.2. *Physiology of fungi.*

Features of mushroom cultivation. Food breathing. Culture media used in mycology. Methods of reproduction. Ecology. Mushrooms - producers of biologically active substances.

2.3.3. *Physiology of protozoa.*

Nutrition, respiration, reproduction, life cycles of protozoa. Features cultivation. Ecology of protozoa.

2.3.4. *Physiology viruses.*

Features biology of viruses. Chemical composition of virions: nucleic acids, proteins, lipids, carbohydrates, and their characteristics. Enzymes viruses.

Types of viral interaction with the cell: a productive , abortive , integrative . Virogeniya.

Reproduction of viruses. The main stage of the interaction of viruses with the cell : adsorption characteristics of viral and cellular receptor ligands ; cell entry mechanisms ; deproteinization ; synthesis of viral macromolecules ; virion assembly ; output of the cell, the way you move  $\neg$  .

Interference. Defective interfering particles and their importance in the development of viral infection. Viruses satellites.

Model for the cultivation of viruses in cell cultures, avian embryos, laboratory animals, their evaluation.

Classification of the cell cultures employed in virology.

Indication of viruses on biological models. Characteristic cytopathogenic effect of the virus in cell cultures.

Viral inclusions. Agar plaque forming under cover.

Gemadsorbtsiya.

Identification of viruses with immunity reactions - RN , DNC , HAI , RP , ELISA, RIA , RIF and other methods of laboratory diagnosis of viral infections : microscopic , virologic , serologiches cue, molecular genetics (PCR , molecular hybridization ) .

Virulent and temperate phages. Step bacteriophages interaction with the cell. Lysogenesis. Phage

conversion.

Practical use of bacteriophages in microbiology and medicine for bacterial identification (epidemiological marking); for the treatment and prevention of infectious diseases in the assessment of environmental health, in biotechnology.

## **2.4. Microbial genetics**

### *2.4.1. Bacterial genetics.*

Determination of bacterial genetics as a science. Its importance in the theory and practice of medicine.

The organization of the genetic material of bacteria. The concept of genotype and phenotype.

Bacterial chromosome. Structure, dimensions, features functioning features of chromosomes eukarioticheskih cells. Functions chromosome. Principles of operation of bacterial genes.

Bacterial plasmids. Structure, replication features. Variety of plasmids: transmissible, netransmissivnye, integrative, neintegrativnye. The concept of compatibility of plasmids.

Determining the presence of plasmids in bacterial cells. Plasmid profile. Its use in the labeling of bacteria epidemic.

Phenotypic expression plasmids. F-, R-, CoI-plasmid. The role of R-plasmids in the spread of antibiotic resistance in bacterial populations.

Virulence plasmid. Their importance in the expression of pathogenicity factors.

The use of plasmids in genetic engineering research.

Mobile genetic elements: intervening sequences and transposons. Their structure. Function of mobile genetic elements and their role in the evolution of bacteria.

Types of variation in bacteria.

Modification variability, its mechanisms and forms.

Genotypic variability. Mutations in bacteria, their varieties: spontaneous and induced, point and chromosomal aberrations; direct, inverse, suppressor. Causes and mechanism of mutations. The concept of mutagens.

Phenotypic expression of mutations in bacteria.

Reparation processes in a bacterial cell. Their role in maintaining genome stability.

Genetic recombination in bacteria. Differences from eukaryotic genetic recombination.

Types of genetic recombination in bacteria: homologous, site-specific, illegal.

Mechanisms for the transfer of genetic information in bacteria: conjugation, transduction, transformation, their use for recombinant strains with desired properties and mapping of the bacterial genome.

Microbiological basis of genetic engineering and biotechnology. The concept of restriction enzymes, polymerases and ligases, and the mechanisms of their action.

Principles of hybrid strains and their use as vaccine strains and strains - producing biologically active substances.

The use of genetic and molecular biology techniques in the diagnosis of infectious diseases: PCR method of molecular probes, the method of "fingerprint".

### *2.4.2. Genetics of viruses.*

Meaning of Virology in the development of genetics. Organization of the genetic apparatus of viruses. DNA and RNA - carriers of genetic information.

Genetic variation of viruses: mutation and recombination. Mutations cause of the. Phenotype.

Genetic interactions between viruses. Recombination. Genetic reactivation. Modification variability of viruses komplementatsiya and phenotypic mixing.

## **2.5. Microbial ecology**

Scientific and social preconditions of environmental microbiology. Natural microbiocenoses. Ecological relationships in mikrobiotsenozah. Symbiosis, commensalism, neutralism, competition, parasitism, predation. Dynamic ecological relationships.

Environmental Protection microbes. Free-living microbes and paraziticheskie. The microflora of the soil. Sources and pathways of pathogenic microbes in the soil. Conditions and terms of their survival in the soil. Sanitary-demonstration soil microorganisms. Microflora reservoirs. Istochniki

and pathways of pathogenic microbes in water. Conditions and terms of the survival of microbes in the water. Microbiological quality of drinking water. Microflora air, indoor air and health care institutions. Routes of entry, terms and conditions of survival of microbes in the air. Sanitary and pokazatelnye microorganisms air. Microbiocenoses foods. Sources and pathways of pathogens in foods. Terms and Conditions of survival in them. Microbiological quality of food. The microflora of household and industrial objects and its role in the spread of infectious diseases.

Principles of sanitary and microbiological studies. Indication of pathogens in the environment, indirect methods: determination of the total microbial contamination and sanitary pokazatelnyh microorganisms.

The role of free-living microorganisms in the formation and development of Earth's biosphere. Participation of microbes in the biogeochemical cycles of chemical elements, synthesis and transformation of organic matter, keeping the planetary radiation balance.

Environmental fungi: soil, phytopathogenic, zoophilic, antropofilnymi.

Microbiological aspects of the environment. The problem of microbiological safety under extreme conditions. Protection from the damaging effect of technological factors groups of microorganisms involved in the cycle of matter and energy. Biological and anthropogenic pollution of the human environment and the role of microbes in biodegradation. Microbial biodegradation of national economic materials, medicines.

## **2.6. The microflora of the human body and its functions**

Normal microflora of the human body (eumikrobiotsenoz). Autochthonous, allochthonous and adventive flora of the external environment tela person. The concept of ecotopes (non-sterile ecotopes body). The microflora of the skin, respiratory tract, digestive and urogenital systems. The microflora of the oral cavity.

Function of the normal microflora: morfokineticheskaya, detoxification, immunogenic, metabolic, regulatory, anti-infective. Role in the development of endogenous infection and spread of genes.

The value in sanitary microbiology.

The role of colonization resistance in the prevention and development of endogenous and exogenous infectious diseases. Ways to improve colonization resistance. Selective and total decontamination. Methods for studying the role of the normal microflora of the human body. Gnotobiologiya. The use of gnotobiotic technology in the clinic when caring for premature babies with congenital immunodeficiency states, for the selection of individual patterns of antimicrobial therapy and to create new bacterial preparations. Factors that influence the quantity and species composition of the microflora of the human body. Dysbiosis. Dysbacteriosis. Methods of study, conditions of occurrence, clinical manifestations, laboratory diagnostika, the practical significance of the study on goiter. Preparations for the recovery of normal human microflora (eubiotics).

Classification eubiotics. The concept of probiotics.

The microflora of the newborn, its formation during the first goda life. Influence mechanism of delivery (natural or cesarean section), environmental health at birth, joint or separate residence of mother and child during the first few days of life, breast-or bottle-feeding on the dynamics of colonization of the organism and the composition of the microflora of the child.

## **2.7. The influence of environmental factors on microbes**

Action of chemical and physical factors on microorganisms. Influence of the temperature of the reaction medium, drying, radiation, ultrasound, chemical agents of various classes. Mechanisms of the damaging effect of these factors. Sterilization. Sterilization methods apparatura. Quality control of sterilization. Disinfection. Asepsis. Antiseptic. The concept of antiseptics and disinfectants.

## **2.8. The antibiotics**

The concept of chemotherapy and antibiotics. History of the development of chemotherapy.

The role of Paul Ehrlich, G. Domagk in the development of chemotherapy.

A. Fleming, Z. Waxman, history of the discovery of antibiotics (penicillin, streptomycin).

Origin of antibiotics, biological role in nature. Methods of obtaining (biological synthesis, chemical synthesis, combined method). Semi-synthetic antibiotics.

Classification of antibiotics in chemical structure. Range of actions.

Mechanisms of antimicrobial action: inhibition of cell wall synthesis peptidoglikana, protein synthesis, nucleic acids, purine and amino disruption of the cytoplasmic membrane.

Bactericidal (fungicidal) and bakterioostaticheskoje (fungiostaticheskoe) the effect of antibiotics. Units antimicrobial activity.

Side effects of antibiotics. Complications of antibiotic therapy on the part of host: a toxic effect of the drug, dysbiosis, allergic, immunosuppressive effects on the body, endotoxic shock.

Side effects on the organism: the formation of atypical forms of microbes. The formation of antibiotic-resistant microbes and antibiotikozavisimyh forms. Genetic and biochemical mechanisms of drug resistance. Ways to overcome drug resistance of bacteria.

Methods of study of antibiotic susceptibility of bacteria in vitro (serial dilution method, the agar diffusion) and in vivo (model germfree animals).

Suppression of antibiotic action of other drugs.

Principles of rational chemotherapy.

Antiviral chemotherapy drugs and interferon inducers, their mechanisms of antiviral action.

Antifungal antibiotics and chemotherapy drugs (antimycotics).

Antiprotozoal chemotherapy drugs.

### **3. Biotechnology and gene engineering**

The concept of biotechnology. Its role and importance in the scientific and technical progress. The main directions of biotechnology. The role of biotechnology in medicine (the creation of new diagnostic, therapeutic and profilakticheskikh drugs to solve balance supply and environmental issues). The main directions of medical biotechnology. The human genome. Biosensors. The basic principles of biotechnology (fermentatsiya, bioconversion, cultivation of microbes, animal and plant cells, gene and cell engineering). Biotechnology products. Modern scientific and industrial base of biotechnology.

Genetic engineering - the core of modern biotechnology. The concept of the gene and methods for its preparation (cloning, sequencing, chemical synthesis). Principles for production of recombinant DNA, creation of the vectors (plasmids, phage DNA, viruses, cosmids). Introduction of recombinant DNA into the cell. Expression and secretion.

Recombinant strains of microorganisms. Hybridomas and their ispolzovanie to produce monoclonal antibodies. Preparations obtained by genetic engineering method (vaccine antigens, diagnostic, hormones, immunomodulators, etc.) And their practical use.

Prospects for the development of biotechnology and genetic engineering.

## ***SPECIAL MEDICAL MICROBIOLOGY***

Definition, goals, objectives and methods of special medical microbiology.

### **1. BACTERIA - INFECTIOUS DISEASES AGENTS**

#### **1.1. Gram-positive cocci**

Evolution coccal bacteria group. Their general characteristics.

##### **1.1.1. Staphylococci.**

Taxonomy. Biological properties. Characterization of toxins and enzymes pathogenicity. Pathogenesis of staphylococcal infections, their role in nosocomial infections. Features immunity. Methods of microbiological diagnosis of staphylococcal processes. Preparations for specific prevention and therapy.

##### **1.1.2. Streptococci.**

Taxonomy. Biological properties. Characterization of toxins and enzymes pathogenicity. The pathogenesis of streptococcal infections. Features immunity. Methods of microbiological diagnosis of streptococcal diseases.

Etiologic and pathogenetic role of group A streptococcal respiratory infections, erysipelas, sore throat, scarlet fever, acute glomerulonephritis, rheumatoid arthritis, dental disease, sepsis, and

others.

*Streptococcus pneumoniae*. Biological properties. Pathogenicity factors. Etiologic and pathogenetic role of *Streptococcus pneumoniae* in human pathology. Microbiological diagnosis. Pathogenicity for humans and animals.

Group B streptococci and their role in the pathology of the newborn.

1.1.3. Enterococci.

Biological properties. Role in human pathology. Enterococci as an indicator of environmental health.

1.1.4. Anaerobic gram-positive cocci - peptokokki, peptostreptokokkov.

Taxonomy. Biological properties. Pathogenicity factors. Role in human pathology. Methods of microbiological diagnostics.

## **1.2. Gram-negative cocci**

1.2.1. Neisseria.

Taxonomy. Biological properties. Pathogenic and pathogenic Neisseria. Pathogenicity for humans. Intracellular parasitism.

1.2.1.1. Meningococcus. Taxonomy. Biological properties. Patogenez meningococcal disease. Microbiological diagnosis. Preparations for specific prevention and treatment etiotrop.

1.2.1.2. Gonococci. Taxonomy. Biological properties. The pathogenesis of gonococcal infection. Microbiological diagnosis of acute and chronic gonorrhea. Prospects for specific prophylaxis. Causative treatment of gonorrhea and blenorei.

1.2.2. Morakselly.

Taxonomy. Biological properties. Role in human pathology.

1.2.3. Anaerobic Gram-negative cocci - veylonelly.

Taxonomy. Biological properties. Pathogenicity factors. Role in human pathology. Methods of microbiological diagnostics.

## **1.3. Gram-negative facultative anaerobic bacillus**

1.3.1. Family Enterobacteriaceae.

Taxonomy. General characteristics, their evolution. Morphological, cultural, biochemical properties. Antigenic structure. Fermenty. Toxins. Bacteriocarrier.

1.3.1.1. Escherichia. Their basic properties. Physiological role in the human gut and sanitary indicative value Escherichia their importance in genetic and genetic engineering experiments. Diarrheagenic Escherichia, their differentiation from opportunistic. Microbiological diagnosis of enteral and parenteral ehsherihioza. Causative treatment.

1.3.1.2. Salmonella. Classification by Kaufmann-White. Patogennost for humans and animals.

Salmonella - germs of typhoid and paratyphoid A and B. The biological properties. Antigenic structure. Pathogenesis of diseases. Pathogenetic bases of microbiological diagnostics. Osobennosti immunity. Bacteriocarrier. Specific prevention and causal treatment.

Salmonella - Salmonellosis. Pathogenesis. The role of enteric and endotoxins in the occurrence of diarrhea syndrome. Microbiological diagnosis. Causal treatment.

Salmonella - pathogens of nosocomial infections.

1.3.1.3. Shigella. Biological properties. The pathogenesis of dysentery. The role of factors invasion, dissemination, and Shiga toxins shigopodobnye toxins. Immunity. Methods of microbiological diagnostics. The problem of specific prophylaxis. Causal treatment.

1.3.1.4. Klebsiella. Their role in the pathology. Characteristics of Klebsiella pneumonia, ozeny, rinoskleromy. Microbiological diagnosis. The problem of specific prophylaxis. Causal treatment.

1.3.1.5. Proteas. Species. Etiologic and pathogenetic role of Proteus in purulent and mixed infections, food poisoning. Role in nosocomial infections. Laboratory diagnostika.

1.3.1.6. Yersinia. The causative agent of plague, history of research, biological properties. The role of Russian scientists in the study of the plague. Pathogenesis, immunity, methods of microbiological diagnosis and prevention spetsificheskoy.

Yersinia - activators of intestinal yersiniosis and pseudotuberculosis. Biological properties. Pathogenicity for humans and animals. Laboratory diagnosis of yersiniosis. Causal treatment.

1.3.1.7. *Morganella*. Biological properties. Role in human pathology. Microbiological diagnosis.

1.3.2. Family *Vibrionaceae*.

Taxonomy. Characteristics of the main properties.

*Vibrio cholerae*, biological properties, biovars. Klassifikatsiya vibrio by Heiberg. Pathogenicity factors. Toxins and harakteristika. Pathogenesis and immunity in cholera. The role of ecosystem mechanism in the spread of cholera. *Vibrionositelstvo*.

Methods of microbiological diagnostics. Specific prevention and treatment of cholera.

1.3.3. Family *Pasteurellaceae*.

*Hemophilia*. Taxonomy. Biological properties. Role in human pathology. Microbiological diagnosis.

#### **1.4. Gram-negative aerobic rods**

1.4.1. *Bordetella*.

Taxonomy. Characteristics of the main properties of *Bordetella*.

The causative agent of whooping cough. Morphological, cultural, antigenic properties. Pathogenicity for humans and localization in the body. Pathogenesis disease in humans.

Immunity. Laboratory diagnosis. Differentiation of pertussis, and Parapertussis bronhoseptikoza. Specific prevention. Causal treatment.

1.4.2. *Brucella*.

Taxonomy. Characteristics of the main properties. Morphological, cultural, biochemical features. Antigenic structure. Differentiation of *Brucella*. Pathogenicity for humans and animals. Factors pathogenesis. Pathogenesis and immunity in brucellosis. Methods of microbiological diagnostics. Preparations for specific prevention and therapy.

1.4.3. *Bartonella*.

Taxonomy. Biological properties. Role in human pathology. Microbiological diagnosis. Causal treatment.

1.4.4. *Frantsissely*.

The causative agent of tularemia. Biological properties. Pathogenesis, immunity, methods of microbiological diagnosis and specific prophylaxis of tularemia.

1.4.5. *Legionella*.

Taxonomy. Characteristics of the main properties of *Legionella*. Ecology. The spread of *Legionella* in the environment. The causative agent of Legionnaires' disease. Morphological, cultural, biochemical features. Antigenic structure. Pathogenicity for humans. Pathogenesis of the disease. Microbiological diagnosis. Prevention. Treatment.

1.4.6. *Pseudomonas*.

Taxonomy. Ecology. Resistance.

*Pseudomonas aeruginosa*. Biological properties. Pathogenicity factors. Pathogenicity for humans. Role in the occurrence of nosocomial infections. Laboratory diagnosis. Causal treatment.

1.4.7. Other genera - kingelly, atsinetobaktery, Burkholder.

Taxonomy. Biological properties. Role in human pathology. The causative agents of glanders, melioidosis.

Microbiological diagnosis. Causal treatment.

#### **1.5. Gram-negative anaerobic rods**

*Bacteroides*, fuzobakterii, leptotrihii, prevotelly, porfiromonady. Taxonomy. Biological properties. Role in human pathology. Microbiological diagnosis. Causal treatment.

#### **1.6. Gram-positive, spore-forming bacillus**

1.6.1. *Clostridia*.

Taxonomy. Ecology. Biological properties. Anaerobiosis. Resistance and environmental factors. Facultative parasitism and pathogenicity to humans. Localization in the body. Toxicity. Genetic control toxin.

1.6.1.1. *Clostridium* anaerobic wound infection. Moore fologicheskie, cultural, biochemical and

antigenic properties. Pathogenicity factors, toxins. Enterotoxin and its role in food poisoning. Pathogenesis of wound anaerobic infections. Role in the pathogenesis of microbial associations. Antitoxic immunity. Laboratory diagnosis. Specific treatment and prevention.

1.6.1.2. *Clostridium tetanus*. Morphological, cultural, biochemical and antigenic properties. Pathogenicity factors, toxins. Pathogenesis of the disease. Tetanus in newborns. Antitoxic immunity. Laboratory diagnosis. Specific treatment and prevention of tetanus.

1.6.1.3. *Clostridium botulinum*. Morphological, cultural, biochemical and antigenic properties. Pathogenicity factors, botulinum toxin, the pathogenesis of the disease. Antitoxic immunity. Laboratory diagnosis. Specific treatment and prevention of botulism.

1.6.1.4. *Clostridium pseudomembranous colitis*. Morpho-logical, cultural, biochemical and antigenic properties. Microbiological diagnosis, etiotropic treatment.

#### 1.6.2. Bacilli.

Taxonomy. Ecology.

Anthrax. Morphological, cultural, biochemical and antigenic properties. Resistance. Pathogenicity of human and animals. Pathogenicity factors, toxins. Pathogenesis of human disease, the immune system. Microbiological diagnosis. Specific treatment and prevention of anthrax. Causative agents of foodborne disease.

### **1.7. Gram-positive rods the correct form**

#### 1.7.1. Listeria.

Taxonomy. Ecology. Morphological, cultural, biochemical and antigenic properties. Resistance. Pathogenicity in animals. Toxin. The pathogenesis of human diseases. Immunity. Microbiological diagnosis. Causative treatment.

#### 1.7.2. Lactobacilli.

Taxonomy. Biological properties. Ecology.

### **1.8. Gram-positive rods of irregular shape and branching (filamentous) bacteria**

#### 1.8.1. *Corynebacterium*.

Taxonomy. Ecology.

The causative agent of diphtheria. Morphological, cultural, biochemical and antigenic properties. Resistance. Biovars. Differentiation of diphtheria and conditionally pathogenic corynebacteria. Factors pathogenicity, diphtheria toxin. The pathogenesis of diphtheria. Antitoxic immunity. Bacteriocarrier. Laboratory diagnosis. Specific treatment and prevention.

#### 1.8.2. Mycobacteria.

Taxonomy. Ecology.

1.8.2.1. The causative agent of tuberculosis. Morphological, cultural, biochemical, antigenic and allergenic properties. Specific of chemical composition and resistance. Pathogenicity factors. The pathogenesis of tuberculosis, especially the immune system. Laboratory diagnosis. Specific treatment and prevention.

The causative agents of mycobacteriosis.

1.8.2.2. The causative agent of leprosy. Morphology, culture. Pathogenesis disease immunity. Laboratory diagnosis. Antimicrobials.

#### 1.8.3. Actinomycetes.

The causative agent of actinomycosis. Ecology. Resistance. The morphological and cultural properties. Pathogenesis of the disease. Immunity. Laboratory diagnosis. Antimicrobials. Immunotherapy. Prevention of actinomycosis.

#### 1.8.4. Pectoris.

Classification. Ecology. Biological properties. Pathogenesis nokarlioza. Laboratory diagnosis. Antimicrobials.

#### 1.8.5. Other genera - bifidobacteria, eubacteria, propionibacteria, mobilunkus.

Taxonomy. Biological properties. Ecology. Role in human pathology.

### **1.9. Spirochetes and other spiral, curved bacteria**

#### 1.9.1. *Treponema*.

The causative agent of syphilis. Morphological, cultural properties. Pathogenesis and immunogenesis. Microbiological diagnosis and causal treatment.

The causative agent of tropical treponematoses - bejel, yaws, pinta. The morphological and cultural properties of pathogens. Path of human infection. Course of the disease in humans. Microbiology diagnosis.

#### 1.9.2. Borrelia.

Causative agents of epidemic and endemic relapsing fever, tick-borne Lyme disease. The morphological and cultural properties. Pathogenesis and immunity. Microbiological diagnosis. Non-specific prevention and treatment.

#### 1.9.3. Leptospira.

Taxonomy. Characterization and differentiation of the basic properties.

The causative agents of leptospirosis. Morphological, cultural properties. Serovars of Leptospira. Pathogenicity for humans and animals. Pathogenesis leptospirosis. Immunity. Microbiological diagnosis. Specific prevention. Treatment.

#### 1.9.4. Campylobacter.

Helicobacter. Taxonomy. Morphological, cultural, biochemical and serological properties. Pathogenicity for humans and animals. Pathogenesis of campylobacteriosis in humans. The role of Campylobacter in the occurrence of gastric ulcer and duodenal ulcer. Microbiological diagnosis. Causal treatment.

### **1.10. Rickettsia. Ehrlichia. Koksielly**

Taxonomy.

Causative agents of epidemic typhus and Brill-Tsins-~~sera~~ disease, murine typhus, tick-borne typhus (north Asian rickettsiosis), tsutsugamushi fever. Pathogen Ku liho-radki. Pathogens ehrlichiosis.

Biological properties. Ecology. Hosts and vectors. Resistance. Cultivation. Intracellular parasitism. Antigenic structure. Pathogenicity factors. Pathogenicity for humans and animals. Immunity.

Laboratory diagnosis. Causal treatment. Specific prevention.

### **1.11. Chlamydia**

Taxonomy. Biological properties. Ecology. Resistance. Cultivation. Intracellular parasitism. Antigenic structure. Pathogenicity factors.

#### 1.11.1. The causative agent of psittacosis.

Pathogenicity for humans and birds. Pathogenesis and immunity. Laboratory diagnosis. Antimicrobials.

#### 1.11.2. Causative agent of trachoma.

Pathogenicity for humans. Role in urogenital pathology. Kon-yunktivit newborns (blenoreya with inclusions), elementary bodies prowazeki-Galbershtedtera. Lymphogranuloma venereum. Pathogenesis. Laboratory diagnosis. Antimicrobials. Prevention.

#### 1.11.3. The causative agent of respiratory chlamydia.

### **1.12. Mycoplasma**

Taxonomy. Biological properties. Ecology. Resistance. Cultivation. Intracellular parasitism. Antigenic structure. Pathogenicity.

Mycoplasma - pathogens of pneumonia, acute respiratory infections, urethritis, endocarditis. The role of mycoplasmas in the pathology of pregnancy and fetal lesions. Mycoplasmas oral cavity. Pathogenesis and im-munitet. Laboratory diagnosis. Causal treatment.

## **2. CAUSAL FUNGUS**

### **2.1. Yeast fungi of the genus Candida**

Ecology. Role in human pathology. Factors contributing to the development of candidiasis (overgrowth, immunodeficiencies). Laboratory diagnosis. Drugs for treatment.

## **2.2. Dermatomitsetami (dermatophytes) - pathogens of tinea: athlete, Trichophyton, Microsporum**

Ecology. Role in human pathology. Laboratory diagnosis. Nonspecific prophylaxis. Drugs for treatment.

## **2.3. The causative agents of deep mycoses: blastomycosis (North and South American), histoplasmosis, cryptococcosis, coccidiosis**

Ecology. Features of biology. Role in human pathology. Drugs for treatment.

## **2.4. The causative agents of fungal infections mold - aspergillosis penitsilleza, zygomycosis**

Ecology. Role in human pathology. Laboratory diagnosis. Drugs for treatment.

## **2.5. Mycotoxicoses**

# **3. PATHOGENIC PROTOZOA**

## **3.1. Plasmodium malaria**

Morphology. Development cycles. The pathogenesis of malaria immunity. Laboratory diagnosis. Prevention. Drugs for treatment.

## **3.2. Toxoplasma, babesii, giardia, leishmania, trypanosomes, trichomonads, amoeba, balantidiums, microsporidia**

Morphology and culture. Pathogenesis. Laboratory diagnosis. Drugs for treatment. Prevention.

# **4. VIRUSES - INFECTIOUS DISEASES AGENTS IN HUMANS**

## **4.1. DNA genomic viruses**

### **4.1.1. Poxviruses (family Poxviridae).**

General characteristics and classification. Variola virus. The structure of the virion. Antigens. Cultivation. Sensitivity to chemical and physical factors. Pathogenic features of the disease. Laboratory diagnosis. Intracellular inclusions (Guarnieri calf).

Specific prevention of smallpox. The global eradication of smallpox. The contribution of the USSR in the smallpox eradication program.

Vaccinia virus. Origin. Antigens. Using genetic engineering.

### **4.1.2. Herpesviruses (family Herpesviridae).**

General characteristics and classification. The structure of the virion. Antigens. Cultivation. Resistance to physical and chemical factors.

Herpes viruses, pathogenic to humans: herpes type I and II, varicella - zoster, cytomegalovirus, Epstein-Barr virus, human herpes virus types 6,7,8. Biological properties. Role in human pathology. Persistence mechanism. Laboratory diagnosis, prevention and treatment specificeskaya herpetic infections.

### **4.1.3. Adenoviruses (family Adenoviridae).**

General characteristics and classification. The structure of the virion. Antigens. Cultivation. Resistance to the action of physical and chemical factors. Pathogenesis of diseases. Persistence. Serotypy oncogenic adenoviruses. Laboratory diagnosis.

### **4.1.4. Hepadnavirus (family Hepadnaviridae) - HBV.**

HBV - the causative agent of hepatitis B. The history of discovery. The structure of the virion. Antigens: HBs, HBc, HBe, HBh, their characteristics. Resistance to physical and chemical factors. Cultivation, and puti mechanism of transmission. Pathogenesis of the disease. Persistenceentsiya. Immunity. Laboratory diagnosis. The problem of vaccine-treatment and non-specific hepatitis B prevention

### **4.1.5. Papovaviruses (family Papovaviridae).**

General characteristics and classification. The morphology of the viruses.

Papillomaviruses and human polyomavirus. Pathogenesis caused za-bolevany. Tumorigenicity.

#### 4.1.6. Parvoviruses (family Parvoviridae).

General characteristics and classification. The structure of the virion. Antigens. Cultivation. Sensitivity to physical and chemical factors. B19 virus, its importance in human pathology.

### 4.2. RNA genome viruses

#### 4.2.1. Reovirus (family Reoviridae).

General characteristics. Classification. Role in human pathology.

Rotaviruses. Classification, general characteristics. Morphology. Role in human pathology. Laboratory diagnosis.

#### 4.2.2. Togavirus (family Togaviridae).

General characteristics. Classification. The structure of the virion. Antigens. Cultivation. Sensitivity to physical and chemical factors. General characteristics of the structure of virions, antigens, and resistance to physical and chemical factors, cultivation, carriers, natural foci, the role in human pathology.

Rhodes rubivirus. Rubella virus. General characteristics. Role in human pathology. Laboratory diagnosis. Specific prevention and treatment of infections togavirusnyh.

#### 4.2.3. Flavivirus (family Flaviviridae).

General characteristics of the virions. Classification. Antigens. Cultivation. Resistance to physical and chemical factors. The main representatives of causing human disease - yellow fever virus, tick-borne encephalitis, dengue fever, Japanese encephalitis, Omsk hemorrhagic fever. Nature centers, the transmission mechanism. Carriers. Pathogenesis. The role of Russian scientists in the study of flavivirus infections (LA Zilber, MP Chumakov AN Shubladze, Lewkowicz et al.). Laboratory diagnosis. Specific prevention and treatment.

The causative agents of hepatitis C, G. Properties. Role in human pathology. Diagnostics.

#### 4.2.4. Bunyaviruses (family Bunyaviridae).

General characteristics and classification. The morphology of the virion. Antigens. Cultivation. Sensitivity to physical and himicheskikh factors.

Bunyaviridae distributed in Russia: Crimean-Congo hemorrhagic fever virus, virus fever mosquito, the virus of hemorrhagic fever with renal syndrome, hantaviruses. Role in human pathology. Transmission mechanism. Laboratory diagnosis. Problems specific prophylaxis.

#### 4.2.5. Arenaviruses (family Arenaviridae).

General characteristics and classification. The main representatives of causing human disease, lymphocytic choriomeningitis virus, Lassa, Junin, Machupo.

#### 4.2.6. Rhabdoviridae (family Rhabdoviridae).

General characteristics and classification. The rabies virus. The structure of the virion. Cultivation. Resistance to physical and himicheskikh factors. Transmission mechanism. Pathogenic features of the disease. Intracellular inclusions (calf Babes-Negri).

Laboratory diagnosis. Specific prevention.

Vesicular stomatitis virus.

#### 4.2.7. Orthomyxoviruses (family Orthomyxoviridae).

General characteristics and classification. Human influenza viruses. The structure and chemical composition of the virion. Features of the genome. Kultivirovanie. Sensitivity to physical and chemical factors. Characterization of antigens. Hemagglutinin, neuraminidase, their localization, structure, classification, functional activity.

Classification of human influenza viruses. Types of antigenic variation, its mechanisms. The pathogenesis of influenza. The value of secondary mikroflory. Role of viral persistence in humans and animals in the preservation of epidemiologically significant strains. Immunity.

Laboratory diagnosis. Specific prevention and treatment.

#### 4.2.8. Paramyxoviruses (family Paramyxoviridae).

General characteristics and classification. The structure of the virion. Hem-agglutination and haemadsorbing properties. Antigens. Cultivation. Resistance to physical and chemical factors. Viruses paragrippa 1-5 person type mumps virus. Role in human pathology. Immunity. Specific prevention. Measles virus biological properties. Pathogenesis of the disease. Immunity and specific

prevention. Respiratory syncytial virus. Biological properties, classification. Pathogenesis of the disease. Immunity.

#### 4.2.9. Picornaviruses (family Picornaviridae).

General characteristics and classification.

The genus Enterovirus. Classification: polioviruses, Coxsackie, ECHO, enteroviruses 68-71. Characteristic virions. Antigens. Cultivation. Pathogenicity in animals. Resistance to the action of physical and chemical factors. The mechanism and pathway.

The role of enteroviruses in human pathology. Pathogenesis of Poliomyelitis and other enterovirus infections. Immunity. Laboratory diagnostics. Specific prevention and therapy.

Rhine Hepatovirus. Hepatitis A virus - the causative agent of infectious hepatitis. Biological properties of the classification. Pathogenesis of the disease. Specific approaches to prevention. Virus hepatitis E.

Laboratory diagnosis of enteroviral infections.

Genus Rhinovirus. General characteristics. Antigens and classification. Pathogenesis of rhinovirus infection. Laboratory diagnostics, specific prevention and treatment.

Rhine Aphotavirus. FMD viruses. Biological properties.

#### 4.2.10. Coronaviruses (family Coronaviridae).

General characteristics. Role in human pathology. Laboratory diagnosis.

#### 4.2.11. Caliciviruses (family Caliciviridae).

General characteristics. Virus hepatitis E.

#### 4.2.12. Retroviruses (family Retroviridae).

General characteristics. Classification.

Human Immunodeficiency Virus. The morphology and chemical composition. Features of the genome. Variability and its mechanisms. Typical composition and classification. Origin and Evolution. Cultivation, reaction step with sensitive cells. Biological models. Resistance to the action of physical and chemical factors.

Pathogenesis of HIV infection. The target cells in humans and their interaction with these cells. Immunological disorders and immunity. AIDS-related infections. Laboratory diagnosis. Treatment (etiologic, immunomodulatory and immunosuppressive therapy). Prospects for specific prophylaxis. Infection control measures.

Pathogen T-cell leukemia (HTLV-I). Pathogen hairy-cell leukemia (HTLV-II). Other members of the family - oncoviruses endogenous viruses.

#### 4.2.13. Unclassified viruses. Virus, hepatitis D; TTV-virus and others.

General characteristics of the structure of virions role in human pathology. Transmission mechanism. Laboratory diagnosis. Treatment (etiologic, immunomodulatory). Nonspecific prophylaxis.

### 4.3. Oncogenic viruses

The history of the development of the role of viruses in carcinogenesis. Virus-genetic theory of cancer among LA Zilber.

Oncogenic RNA viruses of the family Retroviridae. Morphology, classification, features of the interaction with the cell. Endogenous and exogenous retroviruses. The mechanism of tumorigenesis caused by retroviruses. The concept of oncogene. The role of retroviruses in human carcinogenesis: HTLV-I- and HTLV-II-virus.

HCV-virus. Its primary role in the development of liver cancer. Oncogenic DNA viruses. Family Papovaviridae. Morphology, classification, features of the interaction with the cell. Mechanism virus carcinogenesis: the role of p53 and Rb in the development of malignancies caused papovaviruses.

HBV-virus. Its role in the development of antigen-primary liver cancer.

Members of the family Herpesviridae, Adenoviridae, Poxviridae, can cause cell transformation. General characteristics.

### 4.4. Slow viral infections

Modern views on the pathogens of slow viral infections. Persistence of viruses, its mechanisms:

defective interfering particles, the integration of the viral and cellular genomes, "pseudovirus."

State of the system host defense and viral persistence: lack of antibody production, the lack of cell-immunological reaction defective interferon production.

General characteristics of the agents causing slow infections: measles virus, rabies, lentiviruses, the virus of Japanese encephalitis.

Prions. Activators of Kuru, Creutzfeldt-Jakob disease. The pathogenesis of prion diseases in humans and animals. Activation of persistent viruses by physical, chemical and biological factors.

Methods for detection of persistent viruses: serological, molecular biology, electron microscopy, using interference, etc.

## **5. CLINICAL MICROBIOLOGY**

Concept. Goals and objectives. The role of opportunistic bacteria in human pathology. Features of the epidemiology and pathogenesis of opportunistic infections. Nosocomial infections. Features of microbiological diagnosis, prevention and treatment.

## 5. Teaching forms and techniques

Teaching discipline "Microbiology, Virology" is carried out using the following types of educational technology:

- 1) lectures using multimedia technology;
- 2) conducting laboratory studies using microscopic techniques;
- 3) conducting supervision sessions in the form of workshops;
- 4) Individual consultations with the teacher in the performance of tasks in laboratory activities and group counseling before testing for each section of the discipline;
- 5) independent work of students with visual aids;
- 6) involvement of students in research work (s mug, participation in conferences, competitions, etc.).
- 7) In order to implement an individual approach to the teaching of students who carry out the learning process on their own trajectory within the framework of an individual work plan, the study of this discipline is based on the following possibilities: providing out-of-class work with students in the electronic educational environment using appropriate software equipment, distance learning forms, internet resources, individual consultations, etc.

### 5.1. Active teaching methods

#### Case study

Bacteriological method of diagnosis. Food bacteria. nutrient media

#### Solving situation tasks

Morphology of bacteria. The structure of the bacterial cell.

Breathing organisms. Anaerobes

Microbiological diagnosis of bacterial intestinal infections: ehsherihiosis, shigellosis, yersiniosis.

Microbiological diagnosis of bacterial intestinal infections: typhoid, paratyphoid, salmonellosis.

Purulent septic infections. Laboratory diagnosis of ICG caused by anaerobic and facultative anaerobic bacteria.

Purulent septic infections. Activators of anaerobic infections. Prevention of GSI.

Airborne infection.

Pathogenic spirochetes: Treponema, Borrelia, Leptospira.

Causative agents of fungal infections and candidiasis

Human immunodeficiency virus (HIV)

## 6. Teaching and learning materials for students' individual work. Forms of current and interim assessment.

### 6.1. Outline of students' individual work

#### 6.1.1. Plan for individual work of students in semester 4

№	Topic	Type of individual work	Task	Suggested reading material	Hours
1	Subject, tasks, and the history of microbiology. Microbiology laboratory and workplace equipment.	Preparing for the classroom №1	Questions for self-tuition	1. Esaulov A.S, Mitrofanova N.N., Melnikov V.L. An introduction to microbiology. Penza: PSU, 2014. 89 c. <a href="http://microbiolog">http://microbiolog</a>	2

				online.org/	
2	Morphology of bacteria. The structure of the bacterial cell.	Preparing for the classroom №2	Questions for self-tuition, tests for the classroom training №2	Same	2
3	Bacteriological method of diagnosis. Food bacteria. The nutrient medium	Preparing for the classroom №3	Questions for self-tuition, tests for the classroom training №3	Same	2
4	The biochemical properties of the microorganisms.	Preparing for the classroom №4	Questions for self-tuition, tests for the classroom training №4	Same	2
5	Breathing organisms. Anaerobes.	Preparing for the classroom №5	Questions for self-tuition, tests for the classroom training №5	Same	2
6	Antagonism of microbes and antibiotics	Preparing for the classroom №6	Questions for self-tuition, tests for the classroom training №6	Same	2
7	Bacteriophage. Genetics of microorganisms.	Preparing for the classroom №7	Questions for self-tuition, tests for the classroom training №7	Same	2
8	Normal microflora of the human body.	Preparing for the classroom №8	Questions for self-tuition, tests for the classroom training №8	Same	2
9	Ecology of microorganisms. Fundamentals of sanitary microbiology	Preparing for the classroom №9	Questions for self-tuition, tests for the classroom training №9	Same	2
10	Colloquium №1. Morphology, physiology and ecology of microorganisms	Preparing for the Colloquium №1	Questions for the colloquium №1, tests for the colloquium №1	Same	3
11	Microbiological diagnosis of bacterial intestinal infections: esherihiozy, shigellosis, yersiniozis.	Preparing for the classroom №11	Questions for self-tuition, tests for the classroom training №11	Same	2
12	Microbiological diagnosis of bacterial intestinal infections: typhoid, paratyphoid,	Preparing for the classroom №12	Questions for self-tuition, tests for the classroom	Same	2

	salmonellosis.		training №12		
<b>13</b>	Microbiological diagnosis of cholera. Food poisoning is a bacterial etiology. Campylobacteriosis.	Preparing for the classroom №13	Questions for self-tuition, tests for the classroom training №13	Same	2
<b>14</b>	Purulent-septic infections. Laboratory diagnosis of ICG caused by aerobic and facultative anaerobic bacteria.	Preparing for the classroom №14	Questions for self-tuition, tests for the classroom training №14	Same	2
<b>15</b>	Purulent septic infections. Activators of anaerobic infections. Prevention of purulent septic infections	Preparing for the classroom №15	Questions for self-tuition, tests for the classroom training №15	Same	2
<b>16</b>	Airborne infection.	Preparing for the classroom №16	Questions for self-tuition, tests for the classroom training №16	Same	2
<b>17</b>	Laboratory diagnosis of sexually transmitted diseases	Preparing for the classroom №17	Questions for self-tuition, tests for the classroom training №17	Same	2
<b>18</b>	The causative agents of zoonotic infections.	Preparing for the classroom №18	Questions for self-tuition, tests for the classroom training №18	Same	2
<b>19</b>	Colloquium №2. Pathogens of bacterial infections	Preparing for the Colloquium №2	Questions for the colloquium №2, tests for the colloquium №2	Same	3

### 6.1.2 Plan for individual work of students in semester 5

№	Topic	Type of individual work	Task	Suggested reading material	Hours
<b>1</b>	Pathogenic spirochetes: <i>Treponema</i> , <i>Borrelia</i> , <i>Leptospira</i> .	Preparing for the classroom №1	Questions for self-tuition, tests for the classroom training №1	1. Esaulov A.S, Mitrofanova N.N., Melnikov V.L. General microbiology. Penza: PSU, 2014. 89 c. 2. <a href="http://microbiologyonline.org/">http://microbiologyonline.org/</a>	0,5
<b>2</b>	Microbiological diagnosis of	Preparing for the classroom №2	Questions for self-tuition,	Same	0,5

	chlamydia, mycoplasmosis.		tests for the classroom training №2		
<b>3</b>	Microbiological diagnosis of rickettsial diseases.	Preparing for the classroom №3	Questions for self-tuition, tests for the classroom training №3	Same	0,5
<b>4</b>	Pathogenic protozoal infections.	Preparing for the classroom №4	Questions for self-tuition, tests for the classroom training №4	Same	0,5
<b>5</b>	Pathogenic fungi. Features of biology.	Preparing for the classroom №5	Questions for self-tuition, tests for the classroom training №5	Same	0,5
<b>6</b>	The causative agents of fungal infections and Candida.	Preparing for the classroom №6	Questions for self-tuition, tests for the classroom training №6	Same	0,5
<b>7-8</b>	Colloquium №3. Special microbiology	Preparing for the Colloquium №3	Questions for the colloquium №3, tests for the colloquium №3	Same	3
<b>9</b>	General Virology. The structure and characteristics of viruses	Preparing for the classroom №9	Questions for self-tuition, tests for the classroom training №9	Same	1
<b>10</b>	Methods of cultivation and display of viruses.	Preparing for the classroom №10	Questions for self-tuition, tests for the classroom training №10	Same	0,5
<b>11</b>	The causative agents of acute respiratory viral infections	Preparing for the classroom №11	Questions for self-tuition, tests for the classroom training №11	Same	1
<b>12</b>	The causative agents of acute respiratory viral infections. Flu.	Preparing for the classroom №12	Questions for self-tuition, tests for the classroom training №12	Same	0,5
<b>13</b>	Activators of enteroviral infections.	Preparing for the classroom №13	Questions for self-tuition, tests for the classroom training №13	Same	0,5
<b>14</b>	The causative agents of viral hepatitis.	Preparing for the classroom №14	Questions for self-tuition,	Same	1

			tests for the classroom training №14		
15	Causative agents of dangerous viral infections.	Preparing for the classroom №15	Questions for self-tuition, tests for the classroom training №15	Same	0,5
16	Human immunodeficiency virus (HIV)	Preparing for the classroom №16	Questions for self-tuition, tests for the classroom training №16	Same	0,5
17	Herpesviruses	Preparing for the classroom №17	Questions for self-tuition, tests for the classroom training №17	Same	0,5
18-19	Colloquium № 4. General and special virology.	Preparing for the Colloquium №4	Questions for the colloquium №4, tests for the colloquium №4	Same	3

## 6.2. Instructional guidance for individual students' work

Questions for self-training students on individual sections of the discipline are placed in the methodical recommendations for practical training in «Microbiology, Virology», being in FOS.

Extracurricular independent work carried out in the form of training to practical training: preparation of summaries on classes, homework, independent study of individual theoretical questions with the help of textbooks, the report (abstract) on selected topics using special or scientific literature (monographs, articles), conducting research, followed by the writing of abstracts and articles. All this deepens the knowledge gained during the training sessions, promotes the development of independent thinking and to develop skills solving scientific and practical issues of discipline.

**Class study preparation.** Independent work of students should begin with a familiarization with the plan of seminars, which includes questions submitted for discussion, guidelines on the preparation for the workshop recommended literature to the topic. The study material for the practical session should start with watching the lectures. Student translates in the main provisions and issues on the topic, then carefully read the relevant Chapter of the textbook. For a more in-depth study of the issues of taking the recommended basic and additional literature. It is recommended to write in various forms: in the form of deployed and simple plans, statements (abstracts), annotations, and notes.

**Test preparation.** Work with test tasks allows students to systematize their knowledge, exercise your memory, helps getting used to the terminology, works out the correct stylistic approach to formulating a precise response. At the beginning of independent work on the tests the student should be familiar with the thematic plan and content of the theme, study the indicated literature on the list. Tests should be combined with interpretation of key terms used in the text. It is recommended to use the Glossary, available in the learning and teaching literature.

**Control classes preparation.** Preparation and implementation of control classes is a logically linked sequential activities of students. The student has to study theoretical material on the relevant sections of the textbook and additional literature recommended in accordance with the proposed themes. It is recommended to have plans of answers and notes on the books and in accordance with the questions of the test. In the course of self-study each student prepares a speech on all matters of topics. The reports are made orally, deployed, allowed to refer to notes during a speech. Student tests must be active, disciplined and hardworking.

### 6.3. Current and interim assessment materials

#### *Competence development assessment*

No	Type of assessment	Topics (parts) assessed	Competences and elements assessed
1.	Discussion	Topics 1, 2, 3, 4	GEC-1, SPC-1, SPC-2, SPC-5, SPC-6
2.	Test assessment	Topics 1, 2, 3, 4	GEC-1, SPC-1, SPC-2, SPC-5, SPC-6
3.	Colloquium	Topics 1, 2, 3, 4	GEC-1, SPC-1, SPC-2, SPC-5, SPC-6
4.	Course work	Topics 1, 2	GEC-1, SPC-1, SPC-2, SPC-5, SPC-6

#### **Demo variant of test**

1. A major difference between EHEC and EPEC is
  - A. EHEC secretes a Shiga-like toxin and EPEC does not
  - B. EHEC possesses a type III secretion system and EPEC does not
  - C. EPEC rearranges host cell actin and EHEC does not
  - D. EPEC passes through the placenta to infect the fetus and EHEC does not
  
2. The toxins produced by bacteria
  - A. Kill viruses
  - B. Encourage bacterial reproduction
  - C. Interfere with physiological processes in the body
  - D. All of the above
  
3. Type III secretion systems are used to inject "effector" proteins directly into a host cell. Salmonella uses a type III secretion system to help the pathogen to
  - A. Survive the acid pH of the stomach
  - B. Secrete It (heat labile toxin) and st (heat stable toxin) into the lumen of the intestine
  - C. Survive within macrophages
  - D. Activate T cells to proliferate and secrete cytokines
  
4. Which is not a major defense mechanism in the stomach?
  - A. Proteolytic enzymes
  - B. Low pH
  - C. Dense normal flora
  - D. All of these
  
5. The Bacterium that is most commonly used in genetic engineering is
  - A. Escherichia
  - B. Klebsiella
  - C. Proteius
  - D. Serratia
  
6. Endotoxin produced by gramnegative bacteria is present in
  - A. Peptidoglycan
  - B. Lippolysacharide
  - C. Theichoic acid
  - D. Inner membrane

7. Which one of the following was Gramnegative, chemolithotrophic bacteria?  
A. Siderococcus  
B. *E.coli*  
C. Spirellum  
D. Mycoplasmas
8. How would you distinguish pseudomonas species from E-cloi?  
A. Gram staining  
B. Morphology  
C. Glucose fermentation vs respiration  
D. All of the above
9. A population of cells derived from a single cell are called  
A. Monoclonal cells  
B. Clones  
C. Protoplasts  
D. Sub culture
10. Virulence of the microorganisms can be reduced by  
A. Attenuation  
B. A virulence  
C. Inactivation  
D. Freezing
11. The cells having F plasmid in the chromosomes were termed as  
A. Hfr  
B. F-  
C. Hbr  
D. C+
12. Parasitic form must contain  
A. Capsule  
B. Cell-wall  
C. Endospores  
D. Flagella
13. Cell wall of gram negative bacteria is  
A. Thick  
B. Lipids are present  
C. Teichoic acids are absent  
D. None of these
14. A facultative anaerobic is  
A. Only grow anaerobically  
B. Only grow in the presence of o2  
C. Ordinarily an anaerobe but can grow with o2  
D. Ordinarily an aerobe but can grow in absence of O2
15. Exotoxina are  
A. Heat labile  
B. Heat stable  
C. Part of cell wall  
D. Polymerized complexes

16. Rod shaped bacteria are known as  
A. Cocci  
B. Comma forms  
C. Bacilli  
D. Plemorphic froms
17. The differences between Gram positive and Gram negative bacteria is shown to reside in the  
A. Cell wall  
B. Nucleus  
C. Cell membrane  
D. Mesosomes
18. Capsule formation occurs in the presence of  
A. Albumin  
B. Charcoal  
C. Serum  
D. Starch
19. The virulence determining antigens of microorganisms may be  
A. Proteins and polysaccharides  
B. Carbohydrate – protein complexes  
C. Polysaccharide – Phospholipid – Protein complexes  
D. All of these
20. The characteristic shape of the bacteria is maintained because of  
A. Capsule  
B. Cell wall  
C. Cell membrane  
D. Slime layer
21. Bacterial capsule is chemically composed of  
A. Polypeptide  
B. Polynucleotides  
C. Polysaccharides  
D. Polypeptides or polysaccharides
22. The motile bacteria is  
A. *Salmonella typhi*  
B. *Klebsiella pneumoniae*  
C. *Bacillus anthracis*  
D. *Shigella flexneri*
23. *Salmonella typhi* is causative organism of  
A. Undulant fever  
B. Remittent fever  
C. Dengue fever  
D. Enteric fever
24. Which of the following *Salmonella paratyphi* is the commonest in India?  
A. A  
B. B  
C. C  
D. None of these

25. In enteric fever, the organ lodging maximum number of the organism is
- Liver
  - Gall bladder
  - Small intestine
  - Large intestine

#### **Criteria for assessing the test**

- "Excellent" ("5") - 91% or more correct answers to the test.  
"Good" ("4") - 81-90% of correct answers to the test.  
"Satisfactory" ("3") - 71-80% of correct answers to the test.  
"Disappointing" ("2") - 70% or less correct answers to the test.

#### ***The approximate questions for the colloquium***

##### **Morphology, physiology and ecology of microorganisms**

- History of Microbiology. Stages of development. Today's challenges. The contribution of Russian scientists in the development of microbiology and immunology.
- The object and purpose of medical microbiology and immunology. Clinical Microbiology, its task. Criteria for etiologic diagnosis. Diagnosis of nosocomial infections.
- Bacteriological laboratory. Classification and value. Workplace equipment. Rules of conduct in the bacteriological laboratory.
- Major taxonomic groups of microorganisms. The concept of "population", "culture", "strain", "colony", "clone". Bacteria: definition, systematic position. Tests for differentiation of representatives of different families of bacteria.
- Morphological forms of bacteria. The concept of the morphological properties of microorganisms. Filamentous forms of bacteria: actinomycetes pectoris.

##### **The causative agents of bacterial infections**

- Acute intestinal infections and their causative agents. General characteristics of the family of enteric bacteria, the role in human pathology.
- The causative agent of colibacillosis. Characteristics. The role of E. coli in health and disease. Laboratory diagnosis.
- The causative agent of salmonellosis. Microbiological characterization of causative agent. Laboratory diagnosis. Prevention, treatment.
- The causative agent of typhoid. Characteristics. Laboratory diagnosis. Specific prevention and treatment.
- The causative agent of shigellosis. Characteristics. Laboratory diagnosis. Specific prevention and treatment.

##### **Medical microbiology**

- Syphilis. Laboratory diagnosis. Prevention and treatment.
- Relapsing fever. Manifestations. Laboratory diagnosis. Prevention and treatment.
- Lyme disease. Manifestations. Laboratory diagnosis. Prevention and treatment.
- Leptospirosis. Manifestations. Laboratory diagnosis. Prevention and treatment.
- Mycoplasma*. Morphology and structure. Laboratory diagnosis.

##### **General and special virology**

- Viruses as a form of life. The morphology and physiology of virus. Classification of viruses.
- Steps in Viral Replication. Targets for antiviral drugs. Viral isolation and growth.
- Acute respiratory viral infection. Characteristic, laboratory diagnosis, prevention and treatment.
- The causative agent of influenza. Characteristic. Laboratory diagnosis. Specific prevention and treatment.

5. Herpesviruses. Group characteristics. Laboratory diagnosis, prevention and treatment.

### **Criteria for assessing the interview at the colloquium**

"**Excellent**" - the story complete, competent, logical; fluency in terminology; answers to additional questions clear brief.

"**Good**" - the story is not enough to single logical errors in particular; single error in terminology; answers to additional questions correct, clear enough.

"**Satisfactory**" - the story is not enough literate, part-time, with errors in the details; errors in terminology; answers to additional questions is not enough clear, with errors in particular.

"**Disappointing**" - the story of an illiterate, incomplete, with gross errors; ignorance of terminology; answers to additional questions wrong.

### ***The approximate questions of practical skills***

1. Making a smear
2. A simple stain
3. Gram's staining
4. Indirect (negative) staining
5. Culture media
6. Streak plate
7. Using a spreader
8. Pour plate
9. The biochemical properties of the microorganisms
10. Antibiotic sensitivity testing
11. Phage typing

### **Criteria for assessing the practical skills**

"Excellent" ("5") - 91% or more correct answers to the job.

"Good" ("4") - 81-90% of correct answers to the job.

"Satisfactory" ("3") - 71-80% of correct answers to the job.

"Disappointing" ("2") - 70% or less correct answers to the job.

### ***The approximate exam questions***

#### **Morphology, physiology and ecology of microorganisms**

1. Methods for microscopic examination (fluorescent, dark-field, phase contrast, electron microscopy). Bacterioscopic method of diagnosis, its challenges and opportunities
2. Enzymes of bacteria. The concept of the biochemical properties of microorganisms. Automatic regulation of the synthesis of enzymes. Identification of bacteria by enzymatic activity.
3. Types of redox processes in bacteria.
4. The concept of metabolism. Anabolism and catabolism. Characteristics of metabolism in bacteria. Methods of study of bacterial metabolism. Methods for producing bacterial energy. Membrane and substrate phosphorylation.
5. Features of the breathing apparatus of bacteria.

#### **Special bacteriology**

1. The causative agent of intestinal yersiniosis. Characteristics. Laboratory diagnosis. Prevention.
2. The causative agent of cholera. Characteristics. Laboratory diagnosis. Specific prevention and treatment.
3. The causative agent of food poisoning. Laboratory diagnosis. Opportunistic bacteria and their role in the pathology.

4. Campylobacter. Characteristics. Laboratory diagnosis.
5. Staphylococci. Characteristics. Laboratory diagnosis. Specific prevention and treatment.

### **Medical microbiology**

1. *Chlamydia*. Morphology and structure. Laboratory diagnosis. Prevention and treatment.
2. *C. psittaci*. Clinical disease and treatment.
3. Rickettsial disease. Examples of pathogenic *Rickettsiae*. Laboratory diagnosis. Prevention and treatment.
4. Epidemic louse-borne typhus fever. Recrudescence typhus (Brill's disease).
5. Endemic typhus. Laboratory diagnosis. Prevention and treatment.

### **General and special virology**

1. Paramyxoviridae. Measles virus, mumps virus, parainfluenza. Laboratory diagnosis. Specific prevention.
2. The causative agent of mumps. Characteristic. Laboratory diagnosis. Specific prevention and treatment.
3. Adenoviruses. Virology. Laboratory diagnosis.
4. Measles. Characteristic. Laboratory diagnosis. Specific prevention and treatment.
5. The causative agent of rubella. Characteristic. Laboratory diagnosis. Specific prevention and treatment.

### **Criteria for assessing the interview at the exam**

"**Excellent**" - the story complete, competent, logical; fluency in terminology; answers to additional questions clear brief.

"**Good**" - the story is not enough to single logical errors in particular; single error in terminology; answers to additional questions correct, clear enough.

"**Satisfactory**" - the story is not enough literate, part-time, with errors in the details; errors in terminology; answers to additional questions is not enough clear, with errors in particular.

"**Disappointing**" - the story of an illiterate, incomplete, with gross errors; ignorance of terminology; answers to additional questions wrong.

### *The approximate situational tasks*

#### **Situational tasks 1**

An 18-year-old man fell on his knee while playing basketball. The knee was painful, but the overlying skin was unbroken. The knee was swollen and remained painful the next day, so he was taken to the local emergency department. Clear fluid was aspirated from the knee, and the physician prescribed symptomatic treatment. Two days later, the swelling returned, the pain increased, and erythema developed over the knee. Because the patient also felt systemically ill and had an oral temperature of 38.8° C, he returned to the emergency department. Aspiration of the knee yielded cloudy fluid, and cultures of the fluid and blood were positive for \_\_\_\_\_.

*What is the antibiotic of choice for treating this infections? Give two examples.*

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

"**Excellent**" - the story complete, competent, logical; fluency in terminology; answers to additional questions clear brief.

"**Good**" - the story is not enough to single logical errors in particular; single error in terminology;

answers to additional questions correct, clear enough.

"**Satisfactory**" - the story is not enough literate, part-time, with errors in the details; errors in terminology; answers to additional questions is not enough clear, with errors in particular.

"**Disappointing**" - the story of an illiterate, incomplete, with gross errors; ignorance of terminology; answers to additional questions wrong.

### *The approximate topics of course work*

1. Flu vaccine shortages
2. Bacteria with cytoskeletons/evolutionary tree
3. Biofilm formation in disease, the environment, or industry
4. Life in extreme environments
5. Extraterrestrial life
6. Biodegradation of anthropogenic compounds (PCB's, dioxins pesticides, etc.) by bacteria
7. Antibiotic/antiviral resistance mechanisms
8. How to prevent antibiotic resistance
9. Antibacterial products
10. Symbiotic relationships between bacteria and other organisms
11. Viable, but non-culturable organisms
12. Emerging infectious diseases

### *Estimated activities in the performance of course work*

<b>Types of activity</b>	<b>Points</b>
Job analysis, formulated in the form of technical requirements and all existing baseline data for its implementation, elimination of redundant and identification of missing features	15
The choice of methods for the achieve the objectives and rationale for the choice	15
Performance of a task	15
Analysis of the solution and its qualitative evaluation	15
<b>Subtotal</b>	<b>60</b>
Protection of the course work	40
<b>Total</b>	<b>100</b>

## **7. Information materials for the discipline**

### **a) the basic literature**

1. Esaulov A.S, Mitrofanova N.N., Melnikov V.L. General microbiology. Penza: PSU, 2014. 89 c.

### **b) Further literature**

1. «SPECIAL BACTERIOLOGY» A.S. Esaulov, N.A. Pravosudova, L.V. Melnikov, Penza: PSU, 2017. 80 c.
2. «MEDICAL MICROBIOLOGY» A.S. Esaulov, N.A. Pravosudova, L.V. Melnikov, Penza: PSU, 2017. 77 c.
3. «VIROLOGY» A.S. Esaulov, N.A. Pravosudova, L.V. Melnikov, Penza: PSU, 2017. 100 c.

### **c) software and Internet resources**

1. Microsoft Windows (DreamSpark/Microsoft Imagine Standart); reg. number 00037FFEBA CF8FD7, contract №CД-130712001 of 12.07.2013
2. Kaspersky Anti-Virus 2016-2017, reg number KL4863RAUFQ, contract №XII-567116 of 29.08.2016
3. Open source software: Libre Office; Google Chrome; Adobe Reader; 7zip.

4. Medical dictionary <http://medical-dictionary.thefreedictionary.com/>
5. e-books and guides on microbiology  
[http://www.freebookcentre.net/medical\\_text\\_books\\_journals/microbiology\\_ebooks\\_online\\_t\\_exts\\_download.html](http://www.freebookcentre.net/medical_text_books_journals/microbiology_ebooks_online_t_exts_download.html)
6. Quizlet <http://quizlet.com/class/939408/>

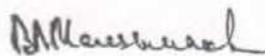
## 8. Equipment

№	Name of special premises and the premises for independent work	Facilities special premises and the premises for independent work
1.	Classroom 18-1, 18th PSU campus building, 36 m <sup>2</sup>	Table - 10 pcs. Chair - 30 pcs. Tumba - 3 pieces. Boards for classrooms - 1 pc. Microbiological preparations. Visual aids (posters). Microscope - 4 pcs. dissecting tools Reagents. Nutrient media. Notebook - 1 pc.
2.	Classroom 18-2, 18th PSU campus building, 36 m <sup>2</sup>	Table - 15 pcs. Chair - 34 pcs. Computer - 2 pieces. Boards for classrooms - 1 pc. Microbiological preparations. Visual aids (posters). Microscope - 4 pcs. dissecting tools Reagents. Nutrient media.
3.	Classroom 18-3, 18th PSU campus building, 36 m <sup>2</sup>	Table - 15 pcs. Chair - 27 pcs. Vanity - 2 pcs. Boards for classrooms - 1 pc. Wardrobe laboratory - 2 pcs. Microbiological preparations. Visual aids (posters). Microscope - 4 pcs. Dissecting tools. Reagents. Nutrient media. Notebook - 1 pc.
4.	Classroom 18-4, 18th PSU campus building, 36 m <sup>2</sup>	Table - 5 pcs. Chair - 23 pcs. Tumba - 5 pcs. Boards for classrooms - 1 pc. Wardrobe laboratory - 3 pieces. Microbiological preparations. Visual aids (posters). Microscope - 4 pcs. Dissecting tools. Reagents. Nutrient media.

The study program for the discipline "Microbiology, Virology" is drawn in accordance with the federal state educational standard of higher education and academic plan for the course **31.05.01 - General Medicine**

The program developers:

1. Head of the department, M.D. prof.



V.L. Melnikov

2. Senior Lecturer

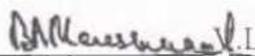


A.S. Esaulov

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The program was discussed and agreed at the department meeting

Records № 13 on « 03 » 03 2016

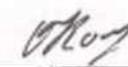
Head of the Department  L. Melnikov

The programme is agreed with the dean of the general medicine faculty of PSU

Dean of GM faculty  Ya. Moiseeva

The programme was approved by methodology council of the Medical Institute

Records № 7 on « 5 » 03 2016

Chair of the methodological commission  O.V. Kalmin

**Сведения о переутверждении программы на очередной учебный год и регистрации изменений**

Учебный год	Решение кафедры (№ протокола, дата, подпись зав. кафедрой)	Внесенные изменения	Номера листов (страниц)		
			замененных	новых	аннулированных
2016/2017	Протокол №1 от 02.09.2016 <i>В.М.Савинов</i>	Программа переутверждена без изменений			
2016/2017	Протокол №18 от 24.05.2017 <i>В.М.Савинов</i>	Внесено изменение в титульный лист РП с «Врач общей практики» на «Врач-лечебник»	1		
2017/2018	Протокол №1 от 30.08.2017 <i>В.М.Савинов</i>	Программа переутверждена без изменений			
2017/2018	Протокол №2 от 04.09.2017 <i>В.М.Савинов</i>	Добавлено в п.5 описание применения образовательных технологий к обучающимся с ограниченными возможностями здоровья и инвалидам			
2018/2019	Протокол №1 от 31.08.2018 <i>В.М.Савинов</i>	Программа переутверждена без изменений			
2019/2020	Протокол №1 от 26.08.2019 <i>В.М.Савинов</i>	Программа переутверждена без изменений			