

MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE RUSSIAN FEDERATION

**Federal State Autonomous Educational Institution of Higher Education
«National Research Lobachevsky State University of Nizhny Novgorod»**

Институт клинической медицины

УТВЕРЖДЕНО

решением Ученого совета ННГУ

протокол № 10 от 02.12.2024 г.

Working programme of the discipline

Microbiology, virusology

Higher education level

Specialist degree

Area of study / speciality

31.05.01 - General Medicine

Focus /specialization of the study programme

General Medicine

Mode of study

full-time

Nizhny Novgorod

Year of commencement of studies 2025

1. Место дисциплины в структуре ОПОП

Дисциплина Б1.О.27 Микробиология, вирусология относится к обязательной части образовательной программы.

2. Планируемые результаты обучения по дисциплине, соотнесенные с планируемыми результатами освоения образовательной программы (компетенциями и индикаторами достижения компетенций)

Формируемые компетенции (код, содержание компетенции)	Планируемые результаты обучения по дисциплине (модулю), в соответствии с индикатором достижения компетенции		Наименование оценочного средства	
	Индикатор достижения компетенции (код, содержание индикатора)	Результаты обучения по дисциплине	Для текущего контроля успеваемости	Для промежуточной аттестации
УК-6: Способен определять и реализовывать приоритеты собственной деятельности и способы ее совершенствования на основе самооценки и образования в течение всей жизни	<p>УК-6.1: Применяет знание о своих ресурсах и их пределах (личностных, ситуативных, временных и т.д.), для успешного выполнения порученной работы и понимает важность планирования перспективных целей собственной деятельности с учетом условий, средств, личностных возможностей, этапов карьерного роста, временной перспективы развития деятельности и требований рынка труда.</p> <p>УК-6.2: Реализует намеченные цели деятельности с учетом условий, средств, личностных возможностей, этапов карьерного роста, временной перспективы развития деятельности и требований рынка труда и критически оценивает эффективность использования времени и других ресурсов при решении поставленных задач, а также относительно полученного результата.</p> <p>УК-6.3: Демонстрирует интерес к учебе и использует предоставляемые возможности для</p>	<p>УК-6.1: Knows the techniques of managing one's time, as well as one's resources and their limits (personal, psychophysiological, situational time, etc.) for the successful fulfillment of assigned work; the technology of planning long-term goals of activity taking into account the conditions, means, personal capabilities, stages of career growth, time perspective of activity development and the requirements of the labor market.</p> <p>УК-6.2: Able to act in conditions of uncertainty, adjusting plans and steps for their implementation taking into account available resources; identifying motives and incentives for self-development, defining realistic goals for professional growth.</p> <p>УК-6.3: Possesses the skills to build a trajectory of self-development and self-education in the field of</p>	<p>Доклад-презентация Коллоквиум Опрос Тест Собеседование</p>	<p>Экзамен: Контрольные вопросы</p>

	приобретения новых знаний и навыков	microbiology and virology, taking into account one's own resources.		
ОПК-6: Способен организовывать уход за больными, оказывать первичную медико-санитарную помощь, обеспечивать организацию работы и принятие профессиональных решений при неотложных состояниях на догоспитальном этапе, в условиях чрезвычайных ситуаций, эпидемий и в очагах массового поражения	ОПК-6.1: Готов применить алгоритм оказания первичной медико-санитарной помощи при неотложных состояниях, в том числе в экстремальных условиях и очагах массового поражения ОПК-6.2: Выявляет состояния, требующие оказания медицинской помощи в экстренной форме, в том числе клинические признаки внезапного прекращения кровообращения и дыхания ОПК-6.3: Оказывает медицинскую помощь в экстренной форме пациентам при состояниях, представляющих угрозу жизни пациентов, в том числе клинической смерти (остановка жизненно важных функций организма человека (кровообращения и (или) дыхания).	ОПК-6.1: Organizes care for sick and injured people at the pre-hospital stage, in particular for those with viral and bacterial infections. ОПК-6.2: Provides primary health care at the pre-hospital stage, including in emergency situations, epidemics and in areas of mass destruction ОПК-6.3: Ensures the organization of work and the adoption of professional decisions in emergency situations, in emergency situations, epidemics and in areas of mass destruction	Доклад-презентация Коллоквиум Опрос Тест Собеседование	Экзамен: Контрольные вопросы

3. Структура и содержание дисциплины

3.1 Трудоемкость дисциплины

	очная
Общая трудоемкость, з.е.	4
Часов по учебному плану	144
в том числе	
аудиторные занятия (контактная работа):	
- занятия лекционного типа	32
- занятия семинарского типа (практические занятия / лабораторные работы)	48
- КСР	2
самостоятельная работа	26
Промежуточная аттестация	36
	Экзамен

3.2. Содержание дисциплины

(структурированное по темам (разделам) с указанием отведенного на них количества академических часов и виды учебных занятий)

Наименование разделов и тем дисциплины	Всего (часы)	в том числе			
		Контактная работа (работа во взаимодействии с преподавателем), часы из них			Самостоятельная работа обучающегося, часы
		Занятия лекционного типа	Занятия семинарского типа (практические занятия/лабораторные работы), часы	Всего	
	0 Ф 0	0 Ф 0	0 Ф 0	0 Ф 0	0 Ф 0
Topic 1. Subject and tasks of microbiology. Position of microorganisms in nature.	6	2	3	5	1
Topic 2. Ultrastructure of a prokaryotic cell.	6	2	3	5	1
Topic 3. Physiology of microorganisms.	5	1	2	3	2
Topic 4. Metabolism and identification of microorganisms.	6	2	3	5	1
Topic 5. Normal human microflora.	6	2	3	5	1
Topic 6. Staphylococci, streptococci and enterobacteria as representatives of human microflora.	6	2	3	5	1
Topic 7. Atypical bacteria.	7	2	3	5	2
Topic 8. Spore-forming and toxin-forming bacteria.	7	2	3	5	2
Topic 9. Antagonism in the world of microorganisms. Antibiotics.	4	1	2	3	1
Topic 10. History of virology. Development of the concept of the nature of viruses. Spread of viruses in the biosphere.	5	1	2	3	2
Topic 11. Structural and molecular organization of viruses.	6	2	3	5	1
Topic 12. Interaction of viruses with cells: stages, morphogenesis, outcomes. Antiviral immunity.	6	2	3	5	1
Topic 13. Genetic classification and taxonomy of viruses.	6	2	3	5	1
Topic 14. Bacteriophages.	4	1	2	3	1
Topic 15. History of oncovirology. Tumor-causing DNA- and RNA-containing viruses.	6	2	2	4	2
Topic 16. Retroviruses. HIV. Retroviruses. HIV.	5	1	2	3	2
Topic 17. Hepatotropic viruses.	6	2	2	4	2
Topic 18. Influenza viruses and other respiratory viruses.	5	2	2	4	1
Topic 19. Neurotropic viruses: polioviruses, herpesviruses.	4	1	2	3	1
Аттестация	36				
КСР	2			2	
Итого	144	32	48	82	26

Contents of sections and topics of the discipline

Topic 1. The subject and tasks of microbiology. The position of microorganisms in nature. Introduction to microbiology. Leeuwenhoek and Leeuwenhoek's microscope as predecessors of microbiology. The subject and tasks of microbiology. Genotypic and phenotypic characteristics of microorganisms. The main domains of cellular organisms on the phylogenetic tree. Classification of microorganisms. Species and strains in microbiology. Properties of microorganism biofilms. Bacterial morphology. The main forms of bacteria. Characteristics of spherical, rod-shaped, spiral forms and polymorphic bacteria.

Topic 2. Ultrastructure of a prokaryotic cell. Vital structures of a bacterial cell. The main differences between pro- and eukaryotic cells. Genetic material of bacteria. Cell wall. Tinctorial properties of a cell. Protoplasts, spheroplasts and L forms in bacteria. Mesosomes. Additional structures of a bacterial cell. Spores. Functions of bacterial spores. Flagella and pili, functions.

Topic 3. Physiology of microorganisms. Aerobic and anaerobic microorganisms. Facultative and obligate microorganisms. Processes of transformation, transfection and conjugation in bacteria. Reproduction of microorganisms. Phases of bacterial growth. Features of cultivation. Nutrient media for bacteria: natural, synthetic, semi-synthetic. Selective and diagnostic media. Influence of environmental factors on bacterial cells (temperature, pH, pressure, etc.). Methods of sterilization and disinfection of microorganisms.

Topic 4. Metabolism and identification of microorganisms. Catabolism and anabolism of bacterial cells. Transport of substances in bacterial cells. Principles of ATP Synthesis in bacteria. Fermentation and respiration of microorganisms. Features of bacterial cell metabolism. Bacterial enzymes. Diagnostic value of bacterial enzymes. Methods of bacterial identification. Identification by enzymatic activity: saccharolytic, proteolytic, etc.

Topic 5. Normal human microflora. Microflora of open and closed biological systems of the human body. Resident and transient human microflora. Human microbiocenoses: skin, gastrointestinal tract, genitourinary system. Biocidal factors of the human body. Causes of quantitative and qualitative changes in the composition of normal microflora. Opportunistic microorganisms. The danger of obligate microorganisms to human health.

Topic 6. Staphylococci, streptococci and enterobacteria as representatives of human microflora. Staphylococci are human symbionts. The main types of staphylococci in the human microflora. Staphylococcal cutaneous and systemic invasions. Specific intoxications of *S. Aureus*. Medical significance of *Staphylococcus epidermidis*, *Staphylococcus saprophyticus*. Hospital infections. Characteristics of streptococci. Alpha-, Beta-, Gamma-streptococci. Antigenic classification of streptococci. The main factors of streptococcal pathogenicity. Local, generalized streptococcal infections, delayed complications. Medical significance of *S. Pyogenes*, *S. pneumoniae*, *S. Agalactiae*, *Neisseria*. The importance of enterobacteria for human health. Pathogenicity factors of *E. coli*. *Escherichia coli*. Diarrheagenic *E. coli*. Extraintestinal *Escherichia coli*.

Topic 7. Atypical bacteria. Atypism of mycobacteria. Pathogenicity factors, medical significance, prevention of mycobacteria *Mycobacterium tuberculosis* and *Mycobacterium leprae*. Atypism of actinomycetes. Features of the pathogenesis of *Actinomyces israelii*. Atypism of spirochetes. Pathological processes, diagnostics and prevention of infections: *Treponema pallidum*, *Treponema pertenue*, *Borrelia recurrentis*, *Borrelia burgdorferi*, *Leptospira interrogans*. Atypism of rickettsia. Tick-borne rickettsiosis (*Rickettsia sibirica*), prevention. Atypism of chlamydia. Pathogenic chlamydia: the causative agent of psittacosis (ornithosis), trachoma, etc. Chlamydia, prevention. Atypism of mycoplasmas. Features of mycoplasmosis.

Topic 8. Spore-forming and toxin-forming bacteria. *Bacillus anthracis*. Pathogenesis of *Bacillus anthracis*:

cutaneous form, pulmonary form, intestinal form. *Bacillus anthracis*. Prevention. General characteristics of clostridia.

Ecology of clostridia. *Clostridium perfringens*, the causative agent of gas gangrene. *C. perfringens* toxins.

Prevention of gas gangrene. *Clostridium tetani*. Conditions for the development of tetanus.

Prodromal phenomena. Exotoxin and endotoxin of *C. Tetani*. Drugs for the specific treatment and prevention of tetanus. *Clostridium botulinum*. Botulinum toxin. Drugs for the specific treatment and prevention of botulism.

Topic 9. Antagonism in the world of microorganisms. Antibiotics. Active and passive antagonism. Unilateral, bilateral, directed antagonism. Antagonistic index. Definition of antibiotics. Classification of antibiotics by sources of isolation (from fungi, actinomycetes, bacteria, animals, plants). Classification of antibiotics by mechanisms of action. Spectra of antimicrobial action of antibiotics.

Topic 10. History of virology. Development of the concept of the nature of viruses. Spread of viruses in the biosphere. Stages of virology development. Descriptive stage: works of Jenner, Pasteur, Loeffler, D.I. Analytical stage: works of Stanley, Kausche, Frenkel-Conrath, Hershey and Chase. Molecular biological stage of virology development: works of Delbrück, Luria, Hershey, Weigl. Modern stage. Cultivation of viruses. Concept of the nature of viruses. Main differences between viruses and other life forms.

Topic 11. Structural and molecular organization of viruses. Virion structure. Capsid, supercapsid. Capsomeres, protomers, peplomers. Virion size and shape. Virion symmetry: icosahedral, helical, complex. Triangulation number. Chemical composition of viruses. Nucleic acids, proteins, enzymes, carbohydrates. Host cell components. Biophysical properties of viruses. Stability of viruses in the environment. Viral genome. Genome size. Nucleic acid type: DNA genomes, RNA genomes. Information capacity of the genome.

Topic 12. Interaction of viruses with the cell: stages, morphogenesis, outcomes. Antiviral immunity. Adsorption. Attachment proteins (VAP proteins). Receptors: bacteriophages, animal viruses (enveloped and nonenveloped). Virion translocation. Penetration and uncoating of viruses (complete and partial) on the cytoplasmic membrane and inside the endosome. Uncapsidation. Penetration of non-enveloped viruses. Reproduction of viruses: dsDNA viruses, ssRNA(+) viruses, dsRNA viruses, ssRNA(-) viruses, retroviruses, pararetroviruses. Defective viral genomes, satellite viruses. Virion morphogenesis: capsid assembly, nucleic acid encapsidation, maturation of non-enveloped viruses, maturation of enveloped viruses. Exit of viral progeny from the cell.

Viral infections: effective, restrictive, abortive infection. Viral infection of the host cell: acute infection, persistent infection (latent, chronic, slow). Natural antiviral defense systems of bacteria (restriction/modification, CRISPR/CAS). Natural antiviral defense systems of plants and animals: RNA silencing, apoptosis, antiviral action of interferon.

Topic 13. Genetic classification and taxonomy of viruses. Systematics of viruses: International Committee on Taxonomy of Viruses; main characteristics used in classifying viruses; classification by David Baltimore; concept of ЁбвдЃв in viruses. The role of viruses in ecosystems: participation of viruses in redistribution of organic matter flows; regulation of the number of host organisms by viruses. Viruses as genetic vectors. Evolution of viruses. Variability of viral genomes. Origin of viruses: viruses as descendants of degraded cells, viruses as descendants of subcellular structures, viruses as independently emerged living beings, an alternative to a living cell.

Topic 14. Bacteriophages. Features of bacteriophage systematics, classification by David Bradley. Features of bacteriophage ontogenesis: adsorption, features of phage penetration, features of phage reproduction, assembly and release of phage virions. Lysogeny (integration and excision of phage λ). Lysogenic conversion. Pseudolysogeny. Transduction. General transduction. Specialized transduction. Bacteriophages with genomic

dsDNA. Bacteriophages with genomic ssDNA(+). Bacteriophages with genomic RNA.

Topic 15. History of oncovirology. Tumor-generating DNA- and RNA-containing viruses. Human T-leukemia/lymphoma virus, human immunodeficiency virus (HIV), human papillomavirus (HPV), hepatitis B and C viruses, Epstein-Barr virus (EBV) and others.

Animal viruses containing dsDNA. Papillomaviridae family: family structure, virion structure, genome structure, reproduction cycle.

Topic 16. Retroviruses. HIV. Viruses containing onRNA(+), having a stage of reverse transcription. Retroviridae family: family structure, virion structure, genome structure, features of genomic RNA replication (reverse transcription process), reproduction cycle.

Topic 17. Hepatotropic viruses. Viruses containing dsDNA and having a stage of reverse transcription. Hepadnaviridae family: family structure, virion structure of human hepatitis B virus (Hepatitis B virus, HBV), genome structure, features of genomic DNA replication, reproduction cycle. Hepatitis D virus (Hepatitis delta virus, HDV).

Topic 18. Influenza viruses and other respiratory viruses. Viruses containing onRNA(+), not having the stage of reverse transcription.

Family Coronaviridae: family structure, virion structure, genome structure, reproduction cycle. Animal viruses containing onRNA(+), not having the stage of reverse transcription. Family Flaviviridae: family structure, virion structure, genome structure, reproduction cycle. Animal viruses containing genomic onRNA(-).

Family Orthomyxoviridae: family structure, virion structure of influenza virus A (Influenzavirus A), genome structure, reproduction cycle, antigenic properties. Animal viruses containing genomic onRNA(-).

Family Paramyxoviridae: family structure, virion structure, genome structure, reproduction cycle.

Topic 19. Neurotropic viruses: polioviruses, herpesviruses. Animal viruses containing onRNA(+), lacking the stage of reverse transcription.

Picornaviridae family: family structure, virion structure, genome structure, reproduction cycle. Animal viruses containing dsDNA.

Herpesviridae family: family structure, virion structure of herpes simplex virus 1 (Human herpesvirus 1, HHV-1), genome structure of HHV-1, reproduction cycle of HHV-1. Other human herpesviruses.

4. Учебно-методическое обеспечение самостоятельной работы обучающихся

Самостоятельная работа обучающихся включает в себя подготовку к контрольным вопросам и заданиям для текущего контроля и промежуточной аттестации по итогам освоения дисциплины приведенным в п. 5.

For independent preparation of the subject, students can use electronic publications:

Anil K. Sharma. Medical Microbiology. - De Gruyter, 2022. - 1 online resource. - ISBN 9783110517736. - ISBN 9783110517644. - Текст : электронный.

<https://e-lib.unn.ru/MegaPro/UserEntry?Action=FindDocs&ids=857334&idb=0>

Medical Microbiology, Virology and Immunology. Lecture Notes / Artamonova; Potaturkina-Nesterova; Ilyina; Nemova. - Москва : ГЭОТАР-Медиа, 2020. - 352 с. - ISBN 978-5-9704-5528-9.

<https://e-lib.unn.ru/MegaPro/UserEntry?Action=FindDocs&ids=869428&idb=0>

Zverev V.V. Medical Microbiology, Virology, Immunology : textbook : Vol. 2. : учебник / Zverev V.V.; Boichenko M.N. - Москва : ГЭОТАР-Медиа, 2020. - 392 с. - ISBN 978-5-9704-5719-1.

<https://e-lib.unn.ru/MegaPro/UserEntry?Action=FindDocs&ids=735471&idb=0>

Zverev V.V. Medical Microbiology, Virology, Immunology : textbook. Vol. 1 : учебник / Zverev V.V.; Boichenko M.N. - Москва : ГЭОТАР-Медиа, 2022. - 384 с. - ISBN 978-5-9704-7072-5.
<https://e-lib.unn.ru/MegaPro/UserEntry?Action=FindDocs&ids=809236&idb=0>
Mikhailova E.A. Microbiology, virology, immunology : учебник / Mikhailova E. A., Aznabayeva L. M., Lyashenko I. E. - Москва : ГЭОТАР-Медиа, 2024. - 560 с. - ISBN 978-5-9704-8641-2.,
<https://elib.unn.ru/MegaPro/UserEntry?Action=FindDocs&ids=935661&idb=0>.
Generalov I. I. Instructions for Laboratory Training in General Microbiology & Immunology /Generalov I. I.,Frolova A. V.,Zheleznyak N. V. - Витебск : ВГМУ, 2023. - 38 с. - Книга из коллекции ВГМУ - Медицина., <https://e-lib.unn.ru/MegaPro/UserEntry?Action=FindDocs&ids=883843&idb=0>.

5. Assessment tools for ongoing monitoring of learning progress and interim certification in the discipline (module)

5.1 Model assignments required for assessment of learning outcomes during the ongoing monitoring of learning progress with the criteria for their assessment:

5.1.1 Model assignments (assessment tool - Report-presentation) to assess the development of the competency УК-6:

Difficulty level - easy.

1. Atypism of mycobacteria.
2. Mycobacterium leprae. Medical significance. Prevention
3. Mycobacterium tuberculosis. Tuberculosis complex. Three stages of tuberculosis. Prevention
4. Atypism of actinomycetes. Factors of pathogenicity of actinomycetes.
5. Actinomycosis. Features of pathogenesis. Prevention of actinomycosis
6. Spirochetes. Atypism of spirochetes.
7. Characteristics of spirochetes Treponema, Borrelia and Leptospira.
8. Treponema pallidum. Prevention.
9. Treponema pertenu. Prevention.
10. Pathogenic leptospire. Prevention of leptospirosis.
11. Pathogenic borrelia. Prevention of borreliosis.
12. Pathogenic rickettsia. Rickettsioses. Prevention.
13. Atypism of chlamydia. Unique life cycle.
14. Chlamydia. Problems of treatment of chlamydia.

15. Atypism of mycoplasmas.
16. Mycoplasmosis. Prevention
17. Diversity of morphological types of viruses.
18. Universality of stages of interaction of viruses with a cell.
19. Principles of taxonomic classification of viruses.
20. Features of the life cycle of bacteriophages.
21. Retroviruses.
22. Hepatoviruses.
23. Orthomyxoviruses.

5.1.2 Model assignments (assessment tool - Report-presentation) to assess the development of the competency OIK-6:

Difficulty level - easy.

1. Pure cultures of microorganisms, methods of isolating pure cultures.
2. Enrichment cultures and the principle of selectivity.
3. Differential diagnostic media.
4. Principles of bacterial identification.
5. Growth and reproduction of microorganisms.
6. Characteristics and classification of bacterial enzymes.
7. Methods of biochemical indication of bacteria.
8. Growth and reproduction of bacteria. Asexual reproduction
9. Mechanisms of transfer of genetic material transformation, transduction, transfection, conjugation.
10. Reproduction and growth of microorganisms during cultivation on an industrial scale.
11. Fundamentals of culturing microorganisms and vaccine preparations.
12. Phases of growth and reproduction of bacteria during periodic cultivation.
13. Requirements for nutrient media. Media of defined and indefinite composition.
14. Natural, semi-synthetic and synthetic media.
15. Main diagnostic media.

16. Consistency of media. Characteristics of media compactors: agar, gelatin, silica gel, carrageenan.
17. Features of cultivation of aerobic and anaerobic microorganisms.
18. Media for cultivation of anaerobic microorganisms.
19. Russian and foreign manufacturers of media for bacteria.
20. Cultural features of microorganisms: growth on dense nutrient media.
21. Characteristics of bacterial colonies. S, R, M and D colonies.
22. Classification of bacteria by sensitivity to pH, temperature, salts.
23. Mechanisms of antibiotic resistance of microorganisms.
24. Rules of asepsis and disinfection.
25. Basic methods of sterilization in hospitals.

Assessment criteria (assessment tool — Report-presentation)

Grade	Assessment criteria
outstanding	The concept of the report is flawlessly developed. The report contains complete information on the presented topic, based on mandatory literary sources and modern publications; the presentation is accompanied by high-quality demonstration material (slide presentation, handouts); the student is fluent in the content, clearly and competently presents the material; freely and correctly answers questions and comments from the audience; fits precisely within the time limit (7 - 10 minutes); all design requirements are met.
excellent	The report contains complete information on the presented topic, based on mandatory literary sources and modern publications; the presentation is accompanied by high-quality demonstration material (slide presentation, handouts); the student is fluent in the content, presents the material clearly and competently; freely and correctly answers questions and comments from the audience; fits precisely within the time limit (7-10 minutes); all design requirements are met.
very good	The presented topic is covered, however the report contains minor inaccuracies regarding the presented topic; the presentation is accompanied by demonstration material (slide presentation, handouts); the speaker presents the material clearly and competently; answers questions and comments from the audience in a reasoned manner, however the speaker made minor errors in presenting the material and answering questions; the design requirements are 80% met
good	The presented topic is covered, however the report contains incomplete information on the presented topic; the presentation is accompanied by demonstration material (slide presentation, handouts); the speaker presents the material clearly and competently; gives reasoned answers to questions and comments from the audience, however the speaker made minor errors in presenting the material and answering questions; the design requirements are

Grade	Assessment criteria
	80% met.
satisfactory	The speaker demonstrates superficial knowledge of the chosen topic, has difficulties using the scientific and conceptual apparatus and terminology of the course; there is no accompanying demonstration material; the design requirements are less than 80% met.
unsatisfactory	The report contains significant gaps in the presented topic, is based on unreliable information; the speaker made fundamental errors in presenting the material; the work does not meet the requirements.
poor	Lack of knowledge on the presented topic; work not presented. The student refused to present the report.

5.1.3 Model assignments (assessment tool - Colloquium) to assess the development of the competency YK-6:

Difficulty level - medium.

1. Mycobacteria. Taxonomy. Morphology.
2. Physiology and metabolism of mycobacteria. Cultural properties. Cultivation media.
3. The cell wall of mycobacteria. Acid resistance of mycobacteria. The mechanism of mycobacteria staining.
4. The main atypical properties of mycobacteria.
5. Factors of mycobacteria pathogenicity.
6. Mycobacterium leprae. Medical significance. Prevention
7. Mycobacterium tuberculosis. Tuberculosis complex. Three stages of tuberculosis. Prevention.
8. Actinomycetes. Taxonomy. Morphological features. Metabolism.
9. Cultivation. Features of actinomycete reproduction. Atypism of actinomycetes
10. Factors of actinomycete pathogenicity. Pathogenesis features. Prevention of actinomycosis
11. Spirochetes. Taxonomy. Structural features. Cultivation and staining.
12. Atypism of spirochetes. Characteristics of spirochete features: Treponema, Borrelia and Leptospira

13. Pathogenic spirochetes. *Treponema pallidum*. Prevention
14. Pathogenic spirochetes. *Treponema pertenue*. Pathogenic leptospira. *Leptospira interrogans*. Prevention.
15. Pathogenic borrelia. *Borrelia recurrentis*. *Borrelia burgdorferi*. Prevention.
16. Rickettsia. Taxonomy. Morphology, cultivation. Metabolic features.
17. Life cycle of rickettsia. Atypism of rickettsia. Factors of pathogenicity of rickettsia.
18. Pathogenic rickettsia.
- Rickettsioses. Prevention.
19. Chlamydia. Taxonomy. Morphology and metabolism. Cultivation of chlamydia. Reproduction method and development cycle.
20. Atypism of chlamydia. Factors of chlamydia pathogenicity.
21. Pathogenic chlamydia. Chlamydia. Problems of chlamydia treatment.
22. Mycoplasmas. Taxonomy. Morphology and metabolism.
23. Ecology of mycoplasmas. Cultural properties. Atypism of mycoplasmas.
24. Factors of mycoplasma pathogenicity. Pathogenic mycoplasmas.
25. Mycoplasmosis. *Ureaplasma urealyticum*.

5.1.4 Model assignments (assessment tool - Colloquium) to assess the development of the competency ОПК-6:

Difficulty level - medium.

1. Opportunistic microorganisms.
2. The danger of obligate microorganisms to human health.
3. Staphylococci as representatives of human microflora.
4. Enterobacteria as representatives of human microflora.
5. Staphylococci are human symbionts.
6. The main types of staphylococci in the human microflora.
7. Staphylococcal cutaneous and systemic invasions.
8. Specific intoxications of *S. Aureus*.
9. Medical significance of *Staphylococcus epidermidis*.
10. Medical significance *Staphylococcus saprophyticus*.

11. Hospital infections.
12. Characteristics of streptococci.
13. Alpha-, Beta-, Gamma-streptococci.
14. Antigenic classification of streptococci.
15. The main factors of streptococcal pathogenicity.
16. Local, generalized streptococcal infections, delayed complications.
17. Medical significance of *S. Pyogenes*.
18. Characteristics of *S. pneumoniae*.
19. Characteristics of *S. Agalactiae*,
20. Characteristics of *Neisseria*.
21. The importance of enterobacteria for human health.
22. Pathogenicity factors of *E. coli*.
23. Characteristics of *Escherichia coli*.
24. Diarrheagenic *E. coli*.
25. Extraintestinal *Escherichia coli*.

Assessment criteria (assessment tool — Colloquium)

Grade	Assessment criteria
outstanding	100% correct answers to all questions. Knowledge of additional material.
excellent	100% correct answers to all questions.
very good	90-95% correct answers to all questions.
good	80 - 70% correct answers to all questions.
satisfactory	50-60% correct answers to all questions.
unsatisfactory	10 -20 % correct answers to all questions.
poor	Complete lack of knowledge. The student refused to answer.

5.1.5 Model assignments (assessment tool - Interview) to assess the development of the competency YK-6:

Difficulty level - medium.

1. The structure of prokaryotes, the main differences from eukaryotes.
2. The cell wall of bacteria. Importance.
3. Features of the chemical structure of the cell wall of gram-positive bacteria.
4. Features of the chemical structure of the cell wall of gram-positive bacteria.
5. Additional structures of the bacterial cell. Pili, simple pili and F-pili.
6. Reserve nutrients - polyphosphates, starch-like inclusions.
7. Functions and specificity of reserve substances for certain species and genera of bacteria.
8. Carbohydrates of bacterial cells - teichoic acids, dextrans.
9. Chemical structure of bacterial peptide. Role in antibiotic resistance.
10. Spherocytes and plasma cells, L-forms of bacteria.
11. Flagella. Types of bacterial movements.
12. Aerobic and anaerobic bacteria.
13. Facultative anaerobes and microaerophiles.
14. The main forms of bacteria.
15. Characteristics of coccoid bacteria.
16. Characteristics of rod-shaped bacteria.
17. Characteristics of spiral bacteria.
18. Metabolic features of bacteria.
19. Transfer of genetic material in microorganisms.
20. Bacterial plasmids.
21. Diversity of morphological types of viruses.
22. Universality of stages of interaction of viruses with the cell.
23. Principles of taxonomic classification of viruses.
24. Features of the life cycle of bacteriophages.
25. Diversity of viral genomes.

5.1.6 Model assignments (assessment tool - Interview) to assess the development of the competency OIK-6:

Difficulty level - medium.

1. Opportunistic microorganisms.
2. The danger of obligate microorganisms to human health.
3. Staphylococci as representatives of human microflora.
4. Enterobacteria as representatives of human microflora.
5. Staphylococci are human symbionts.
6. The main types of staphylococci in the human microflora.
7. Staphylococcal cutaneous and systemic invasions.
8. Specific intoxications of *S. Aureus*.
9. Medical significance of *Staphylococcus epidermidis*.
10. Medical significance *Staphylococcus saprophyticus*.
11. Hospital infections.
12. Characteristics of streptococci.
13. Alpha-, Beta-, Gamma-streptococci.
14. Antigenic classification of streptococci.
15. The main factors of streptococcal pathogenicity.
16. Local, generalized streptococcal infections, delayed complications.
17. Medical significance of *S. Pyogenes*.
18. Characteristics of *S. pneumoniae*.
19. Characteristics of *S. Agalactiae*,
20. Characteristics of *Neisseria*.
21. The importance of enterobacteria for human health.
22. Pathogenicity factors of *E. coli*.
23. Characteristics of *Escherichia coli*.
24. Diarrheagenic *E. coli*.
25. Extraintestinal *Escherichia coli*.

Assessment criteria (assessment tool — Interview)

Grade	Assessment criteria
outstanding	The level of knowledge exceeds the volume of the training program, without errors.

Grade	Assessment criteria
excellent	The level of knowledge corresponds to the training program, without errors.
very good	The level of knowledge corresponds to the training program. One or two minor errors were made.
good	The level of knowledge corresponds to the training program. Several minor errors were made.
satisfactory	Minimum acceptable level of knowledge. Many minor errors were made.
unsatisfactory	The level of knowledge is below the minimum requirements. There were serious errors.
poor	No knowledge. The student refused to answer questions.

5.1.7 Model assignments (assessment tool - Test) to assess the development of the competency YK-6:

Difficulty level - medium.

1. Opportunistic infections:

a) caused only by pathogenic microorganisms;

b) caused by opportunistic microorganisms;

c) occur in immunosuppressive states;

d) can affect any organs and tissues.

2. Features of opportunistic infections:

a) treatment with a combined ratio of antibacterial therapy with immunomodulatory;

b) widespread in hospitals;

c) complexity of the course;

d) highly contagious.

3. Diagnosis of opportunistic infections:

a) the main diagnostic method is microbiological;

b) the main diagnostic method is biological;

c) use of qualitative and quantitative criteria;

d) use of only qualitative criteria.

4. Bacteremia is:

a) the phase of pathogenesis of infectious diseases, during which bacteria enter the blood;

b) the phase of pathogenesis of infectious diseases during which viruses enter the blood;

c) a generalized disease during which the pathogen is present and multiplies in the blood.

5. Sepsis is:

- a) the phase of pathogenesis of infectious diseases during which bacteria enter the blood;
- b) the phase of pathogenesis of infectious diseases during which viruses enter the blood;
- c) a generalized disease during which the pathogen is present and multiplies in the blood.

6. Nosocomial infection is:

- a) an infectious disease acquired and manifested in a hospital setting;
- b) an infection acquired within a hospital and manifested in a hospital setting or after discharge from it;
- c) an infection acquired before admission to hospital and manifested or detected in the hospital.

7. The main antigens of staphylococci:

- a) protein M;
- b) Vi-antigen;
- c) K-antigen;
- d) protein A.

8. The main antigens of streptococci:

a) protein M;

b) Vi-antigen;

c) K-antigen;

d) protein A.

9. Staphylococcal infections include:

a) scalded baby syndrome;

b) scarlet fever;

c) carbuncle;

d) toxic shock syndrome.

10. The staphylococcal enzyme plasmacoenagulase causes:

a) destruction of hyaluronic acid;

b) blood clotting disorder;

c) destruction of lecithin;

d) dissolution of fibrin.

11. The enzyme hyaluronidase causes: a) destruction of hyaluronic acid; b) blood clotting disorder; c) lecithin destruction; d) fibrin dissolution.

12. The enzyme lecithinase causes:

a) hyaluronic acid destruction;

b) blood clotting disorder;

c) lecithin destruction;

d) fibrin dissolution.

13. Fibrinolysin causes:

a) hyaluronic acid destruction;

b) blood clotting disorder;

c) lecithin destruction;

d) fibrin dissolution.

14. L-forms of staphylococci are characterized by:

- a) resistance to penicillin antibiotics;
- b) ability to persist in the body for a long time;
- c) presence of a thick cell wall;
- d) change in morphology.

15. Staphylococci belong to the family: a) Bacteroidaceae; b) Neisseriaceae; c) Pseudomonadaceae; d) Micrococcaceae; e) Enterobacteriaceae.

16. Staphylococci cause infectious processes:

a) only the nasopharynx; b) only wounds; c) purulent-inflammatory processes of any organs and tissues; d) only septic processes.

17. The pathogenicity factors of staphylococci are:

a) microcapsule; b) the presence of spores; c) coagulase; d) catalase; e) beta-lactamase.

18. The following signs are characteristic of all representatives of the Micrococcaceae family:

1) the presence of spores;

2) motility;

3) positive Gram staining;

4) positive catalase test;

5) the presence of pigment;

6) spherical shape of cells;

7) positive oxidase test.

a) 1, 3, 5 are correct; b) 3, 4, 6 are correct; c) 2, 5, 7 are correct.

19. Human diseases are caused by representatives of the following genera of the Micrococcaceae family: a) micrococci;

b) stomatococci;

c) planococci;

d) staphylococci.

20. The following features are characteristic of the genus staphylococci:

1) arrangement of cells in clusters;

2) presence of spores;

3) motility;

4) anaerobic fermentation of glucose;

5) growth on agar with furazolidone;

6) resistance to lysostaphin;

7) presence of teichoic acids.

a) 1, 4, 7 are correct; b) 2, 4, 6 are correct; c) 1, 3, 5 are correct.

ANSWERS TEST 1

1. а	11. а, б, г
2. а, б, в	12. г
3. а, б	13. а, б
4. д	14. б
5. в, г	15. а, д
6. а	16. д
7. а	17. а
8. б, в, д	18. а, б, в
9. б	19. в, г
10. б	20. в

5.1.8 Model assignments (assessment tool - Test) to assess the development of the competency ОПК-6:

Difficulty level - medium.

1. According to the type of respiration, staphylococci are:

- a) aerobes;
- b) anaerobes;
- c) microaerophiles;
- d) facultative anaerobes.

2. The following tests are used for intraspecific differentiation of the genus of staphylococci:

- a) the presence of plasma coagulase;
- b) the presence of hyaluronidase;
- c) the presence of catalase;
- d) the presence of fibrinolysin.

3. Among the coagulase-negative species of staphylococci, the following most often cause human diseases:

- a) *S. epidermidis*;
- b) *S. warneri*;
- c) *S. haemolyticus*;
- d) *S. saprophyticus*.

4. The following signs are characteristic of epidermal staphylococcus:

- 1) the presence of phosphatase;
- 2) the ability to break down mannose; 3) the ability to aerobically split mannitol;
- 4) the presence of plasma coagulase;
- 5) the presence of sensitivity to novobycin.

a) 1, 3, 5 are correct; b) 3, 2, 4 are correct; c) 1, 2, 5 are correct.

5. The following signs are characteristic of *S. saprophyticus*: a) the presence of the enzyme DNase; b) the ability to split sucrose; c) the presence of plasma coagulase; d) the presence of phosphatase.

6. The following media can be used for the primary cultivation of staphylococci:

- a) Lowenstein-Jensen medium;
- b) Endo medium;
- c) simple nutrient agar;

d) Yolk-salt agar.

7. The following nutrient media can be used for the cultivation of streptococci:

a) blood agar;

b) salt agar;

c) serum agar;

d) Endo medium.

8. For intraspecific differentiation of streptococci use:

a) morphological features;

b) features of hemolytic activity;

c) serological studies;

d) study of biochemical activity.

9. The serological method of grouping streptococci according to R. Lensfield is based on:

a) study of biochemical activity;

b) detection of a specific group polysaccharide of the cell wall;

c) determination of streptolysins;

d) determination of hyaluronidase;

d) determination of streptokinase.

10. In human pathology, the main role belongs to streptococci:

a) serological group A;

b) serological group C;

c) serological group B.

11. The main role in human pathology belongs to the following types of streptococci:

1) *S.pyogenes*;

2) *S.agalactiae*;

3) *S.pneumoniae*;

4) *S.salivarius*;

5) *S.sanguis*.

a) 1, 2, 3 are correct; b) 2, 3, 5 are correct; c) 1, 3, 4 are correct.

12. The following signs are characteristic of streptococci of serological group A:

1) hemolysis;

2) hyaluronidase;

3) oxidase;

4) catalase;

5) urease.

a) 1, 2 are correct; b) 3, 4 are correct; c) 2, 4 are correct.

13. For *Str. pneumoniae* are characterized by the following signs:

a) α -hemolysis;

b) sensitivity to optochin;

c) lysis by bile;

d) no growth on saline media;

d) negative Gram staining.

14. The ability of *Staphylococcus aureus* to synthesize exfoliatins can cause:

a) scarlet fever rash;

b) activation of cAMP formation;

c) staphylococcal toxic shock syndrome;

d) scalded skin syndrome.

15. Gram-positive cocci are:

a) gonococci;

b) pneumococci;

c) enterococci;

d) staphylococci;

d) meningococci

e) streptococci.

16. Gram-negative cocci are:

a) staphylococci;

b) pneumococci;

c) enterococci;

d) gonococci;

d) streptococci

e) meningococci.

17. For the treatment of staphylococcal infections the following are used:

a) staphylococcal toxoid;

b) staphylococcal vaccine;

c) diagnostic staphylococcal phages;

d) antistaphylococcal immunoglobulin.

18. For specific prevention of staphylococcal infections the following can be used:

a) staphylococcal toxoid;

b) antistaphylococcal immunoglobulin;

c) O-streptolysin;

d) antibiotics.

19. The main method of laboratory diagnosis of staphylococcal infections is:

a) bacterioscopic; b) bacteriological; c) serodiagnosis; d) allergy diagnostics.

20. The causative agents of scarlet fever include:

a) *S. aureus*;

b) *S. pyogenes*;

c) *E. faecalis*;

d) *S. pneumoniae*;

e) S. salviarius.

ANSWERS TEST 2

1. а, г, д	11. в
2. в	12. б
3. б	13. а
4. д	14. а
5. б, в, г, д	15. а
6. а, б, г, д	16. б, в, г
7. в	17. а, б, в, д
8. г	18. а
9. а	19. г
10. б, в	20. а, в, г

Assessment criteria (assessment tool — Test)

Grade	Assessment criteria
outstanding	100% correct answers
excellent	90 – 99 % correct answers
very good	80 – 90 % correct answers
good	70-80 % correct answers
satisfactory	50-70 % correct answers
unsatisfactory	20 – 40 % correct answers
poor	0 – 20 % correct answers. The student refused to answer.

5.1.9 Model assignments (assessment tool - Interview) to assess the development of the competency YK-6:

Difficulty level - medium.

1. Normal human microflora.
2. Obligatory and transient human microflora.
3. Microflora of human skin.
4. Microflora of human mucous membranes.
5. Preparation of dental plaque preparation.
6. Microflora culture by the print method.
7. Staphylococci - representatives of human normal flora.
8. Streptococci - representatives of human normal flora.
9. Enterobacteria - representatives of human normal flora.
10. Spore formation as a diagnostic sign of bacteria.
11. Detection and staining of bacterial spores.
12. Detection of spores by the Orzeszko method.
13. Bacterial encapsulation. Diagnostic value.
14. Detection of capsules according to Burri - Gins.
15. Streak inoculation of bacterial culture on slanted agar.
16. Detection of bacterial motility.
17. Phase-contrast microscopy.
18. Suspension inoculation using the "continuous lawn" method.
19. Microorganism antagonism. Types of antagonism.
20. Antibiotics. Mechanisms of action.
21. Bacterial sensitivity to antibiotics.
22. Method for studying bacterial antibiotic resistance.
23. Study of physiological properties of microorganisms.

24. Differential diagnostic media.

25. Bacterial differentiating plates.

5.1.10 Model assignments (assessment tool - Interview) to assess the development of the competency OIK-6:

Difficulty level - medium.

1. Safety rules when working with microorganisms.
2. Basic rules for working in a microbiological laboratory.
3. Sterilization. Basic sterilization methods.
4. Preparing equipment for sterilization: pipettes, test tubes, flasks, Petri dishes, cotton-gauze stoppers.
5. Nutrient media for microorganisms.
6. Classification of nutrient media.
7. Preparation of nutrient media.
8. Taking a sample of microflora.
9. The method of sedimentation of microorganisms.
10. Carrying out bacteriological analysis.
11. Methods for isolating pure cultures.
12. Methods for identifying microbes.
13. Preparation of serial dilutions of soil suspension.
14. Identification of cultural properties of microorganisms.
15. Express method for determining the gram-type of bacteria.
16. Staining bacteria with simple dyes.
17. Complex strains of bacteria.
18. Description of bacterial cultures.

19. Characteristics of bacterial colonies on solid media.

20. Screening of pure culture on slanted MPA.

21. Methods for identifying morphological features.

22. Preparation of fixed preparations.

23. Gram staining.

Assessment criteria (assessment tool — Interview)

Grade	Assessment criteria
outstanding	The level of knowledge exceeds the volume of the training program, without errors.
excellent	The level of knowledge corresponds to the training program, without errors.
very good	The level of knowledge corresponds to the training program. One or two minor errors were made.
good	The level of knowledge corresponds to the training program. Several minor errors were made.
satisfactory	Minimum acceptable level of knowledge. Many minor errors were made.
unsatisfactory	The level of knowledge is below the minimum requirements. There were serious errors.
poor	No knowledge. The student refused to answer questions.

5.2. Description of scales for assessing learning outcomes in the discipline during interim certification

Шкала оценивания сформированности компетенций

Уровень сформированности компетенций (индикатора достижения компетенций)	плохо	неудовлетворительно	удовлетворительно	хорошо	очень хорошо	отлично	превосходно
	не зачтено		зачтено				
<u>Знания</u>	Отсутствие знаний теоретического материала. Невозможность оценить полноту знаний вследствие	Уровень знаний ниже минимальных требований. Имели место грубые ошибки	Минимально допустимый уровень знаний. Допущено много негрубых	Уровень знаний в объеме, соответствующем программе подготовки. Допущено	Уровень знаний в объеме, соответствующем программе подготовки. Допущено	Уровень знаний в объеме, соответствующем программе подготовки. Ошибок	Уровень знаний в объеме, превышающем программу подготовки.

	отказа обучающегося от ответа		ошибок	несколько негрубых ошибок	несколько несущественных ошибок	нет.	
<u>Умения</u>	Отсутствие минимальных умений. Невозможность оценить наличие умений вследствие отказа обучающегося от ответа	При решении стандартных задач не продемонстрированы основные умения. Имели место грубые ошибки	Продemonстрированы основные умения. Решены типовые задачи с негрубыми ошибками. Выполнены все задания, но не в полном объеме	Продemonстрированы все основные умения. Решены все основные задачи с негрубыми ошибками. Выполнены все задания в полном объеме, но некоторые с недочетами	Продemonстрированы все основные умения. Решены все основные задачи. Выполнены все задания в полном объеме, но некоторые с недочетами	Продemonстрированы все основные умения. Решены все основные задачи с отдельным и несущественными недочетами, выполнены все задания в полном объеме	Продemonстрированы все основные умения. Решены все основные задачи. Выполнены все задания, в полном объеме без недочетов
<u>Навыки</u>	Отсутствие базовых навыков. Невозможность оценить наличие навыков вследствие отказа обучающегося от ответа	При решении стандартных задач не продемонстрированы базовые навыки. Имели место грубые ошибки	Имеется минимальный набор навыков для решения стандартных задач с некоторыми недочетами	Продemonстрированы базовые навыки при решении стандартных задач с некоторыми недочетами	Продemonстрированы базовые навыки при решении стандартных задач без ошибок и недочетов	Продemonстрированы навыки при решении нестандартных задач без ошибок и недочетов	Продemonстрирован творческий подход к решению нестандартных задач

Scale of assessment for interim certification

Grade		Assessment criteria
pass	outstanding	All the competencies (parts of competencies) to be developed within the discipline have been developed at a level no lower than "outstanding", the knowledge and skills for the relevant competencies have been demonstrated at a level higher than the one set out in the programme.
	excellent	All the competencies (parts of competencies) to be developed within the discipline have been developed at a level no lower than "excellent",
	very good	All the competencies (parts of competencies) to be developed within the discipline have been developed at a level no lower than "very good",
	good	All the competencies (parts of competencies) to be developed within the discipline have been developed at a level no lower than "good",
	satisfactory	All the competencies (parts of competencies) to be developed within the discipline have been developed at a level no lower than "satisfactory", with at least one competency developed at the "satisfactory" level.
fail	unsatisfactory	At least one competency has been developed at the "unsatisfactory" level.
	poor	At least one competency has been developed at the "poor" level.

5.3 Model control assignments or other materials required to assess learning outcomes during the interim certification with the criteria for their assessment:

5.3.1 Model assignments (assessment tool - Control questions) to assess the development of the competency YK-6

Difficulty level - medium.

1. Natural bacterial communities.
2. Types of relationships – commensalism, syntrophy, metabiosis.
3. Relationships between microorganisms and the body.
4. Various representatives of the animal world.
5. Entry of nutrients into a bacterial cell.
6. Penetration of exogenous substances into the cell, diffusion and active transport.
7. Sources of nutrition for bacteria. Methods of nutrition for microorganisms.
8. Diversity of nutritional needs of microorganisms. The role of water in the nutrition of microorganisms.
9. Normal human microflora.
10. Microorganisms of human skin.
11. Microflora of the human mucous membranes.
12. Microorganisms of the gastrointestinal tract.
13. Microflora of the respiratory tract.
14. Forms of existence of the virus. Extracellular form of the virus.
15. Virion architecture. Nomenclature of terms.
16. Morphological types of viral particles. Symmetry types of viral particles.
17. Structural features of enveloped virions.
18. Chemical composition of viruses. Structural and non-structural proteins of the virus.
19. Enzymes involved in the life cycle of the virus.
20. Lipids of the virus.
21. Nucleic acids of the virus.

22. Types of DNA genomes of the virus.
23. Types of RNA genomes of the virus.
24. The concept of susceptibility of the organism to viruses and their tissue tropism.
25. Stages of interaction of the virus with the cell.
26. Adsorption of the virus on the cell surface. The main mechanisms of penetration of viruses into the cell.
27. Stages of intracellular reproduction of viruses.
28. General principles of morphogenesis of viral particles.
29. Types of interaction of viruses with the cell depending on the outcome.
30. Types of interaction of viruses with the cell depending on the duration.
31. Defective viruses.
32. Formal taxa in the kingdom Vira.
33. Intraspecific differentiation of viruses.
34. Classification of viruses based on the type of genome.
35. Genomic clusters.

5.3.2 Model assignments (assessment tool - Control questions) to assess the development of the competency ОПК-6

Difficulty level - medium.

1. General characteristics of clostridia. Ecology of clostridia.
2. Clostridium perfringens, the causative agent of gas gangrene.
3. C.perfringens toxins.
4. Prevention of gas gangrene.
5. Clostridium tetani.
6. Conditions for the development of tetanus.
7. Prodromal phenomena.
8. Exotoxin and endotoxin of C. Tetani.
9. Drugs for specific treatment and prevention of tetanus.
10. Clostridium botulinum. Botulinum toxin.

11. Drugs for specific treatment and prevention of botulism.
12. Spore-forming and toxin-forming bacteria.
13. Bacillus anthracis. Spore resistance and ecology.
14. Pathogenesis of Bacillus anthracis: cutaneous form, pulmonary form, intestinal form.
- 15..Bacillus anthracis. Prevention.
16. Antagonism in the world of microorganisms.
17. Antibiotics. Active and passive antagonism.
18. Unilateral, bilateral, directed antagonism. 19. Antagonistic index.
90. Definition of antibiotics.
21. Classification of antibiotics by sources of isolation (from fungi, actinomycetes, bacteria, animals, plants). 22. Classification of antibiotics by mechanisms of action.
23. Spectra of antimicrobial action of antibiotics.
24. Tumor-causing DNA- and RNA-containing viruses.
25. Retroviruses. HIV.
26. Hepatotropic viruses. Family Hepadnaviridae.
27. Influenza viruses and other respiratory viruses.
28. Coronaviridae. Flaviviridae.
29. Orthomyxoviridae. Paramyxoviridae.
30. Neurotropic viruses: polioviruses, herpesviruses.
31. Family Picornaviridae.
32. Family Herpesviridae: family structure, virion structure, reproduction cycle.

Assessment criteria (assessment tool — Control questions)

Grade	Assessment criteria
outstanding	100% correct answers
excellent	90 – 99 % correct answers
very good	80 – 90 % correct answers
good	70-80 % correct answers

Grade	Assessment criteria
satisfactory	50-70 % correct answers
unsatisfactory	20 – 50 % correct answers
poor	0 – 20 % correct answers. The student refused to answer.

6. Учебно-методическое и информационное обеспечение дисциплины (модуля)

Основная литература:

1. Anil K. Sharma. Medical Microbiology. - De Gruyter, 2022. - 1 online resource. - ISBN 9783110517736. - ISBN 9783110517644. - Текст : электронный., <https://e-lib.unn.ru/MegaPro/UserEntry?Action=FindDocs&ids=857334&idb=0>.
2. Medical Microbiology, Virology and Immunology. Lecture Notes / Artamonova; Potaturkina-Nesterova; Ilyina; Nemova. - Москва : ГЭОТАР-Медиа, 2020. - 352 с. - ISBN 978-5-9704-5528-9., <https://e-lib.unn.ru/MegaPro/UserEntry?Action=FindDocs&ids=869428&idb=0>.
3. Zverev V.V. Medical Microbiology, Virology, Immunology : textbook : Vol. 2. : учебник / Zverev V.V.; Boichenko M.N. - Москва : ГЭОТАР-Медиа, 2020. - 392 с. - ISBN 978-5-9704-5719-1., <https://e-lib.unn.ru/MegaPro/UserEntry?Action=FindDocs&ids=735471&idb=0>.
4. Zverev V.V. Medical Microbiology, Virology, Immunology : textbook. Vol. 1 : учебник / Zverev V.V.; Boichenko M.N. - Москва : ГЭОТАР-Медиа, 2022. - 384 с. - ISBN 978-5-9704-7072-5., <https://e-lib.unn.ru/MegaPro/UserEntry?Action=FindDocs&ids=809236&idb=0>.
5. Elias Hakalehto. Microbiology of Food Quality : Challenges in Food Production and Distribution During and After the Pandemics. - De Gruyter, 2022. - 1 online resource. - ISBN 9783110724967. - ISBN 9783110724929. - Текст : электронный., <https://e-lib.unn.ru/MegaPro/UserEntry?Action=FindDocs&ids=857705&idb=0>.
6. Mikhailova E.A. Microbiology, virology, immunology : учебник / Mikhailova E. A., Aznabayeva L. M., Lyashenko I. E. - Москва : ГЭОТАР-Медиа, 2024. - 560 с. - ISBN 978-5-9704-8641-2., <https://e-lib.unn.ru/MegaPro/UserEntry?Action=FindDocs&ids=935661&idb=0>.
7. Generalov I. I. Instructions for Laboratory Training in General Microbiology & Immunology / Generalov I. I., Frolova A. V., Zheleznyak N. V. - Витебск : ВГМУ, 2023. - 38 с. - Книга из коллекции ВГМУ - Медицина., <https://e-lib.unn.ru/MegaPro/UserEntry?Action=FindDocs&ids=883843&idb=0>.

Дополнительная литература:

1. Zverev V.V. Medical Microbiology, Virology, Immunology : textbook. Vol. 1 : учебник / Zverev V.V.; Boichenko M.N. - Москва : ГЭОТАР-Медиа, 2020. - 384 с. - ISBN 978-5-9704-5607-1., <https://e-lib.unn.ru/MegaPro/UserEntry?Action=FindDocs&ids=735461&idb=0>.
2. Zverev V.V. Medical Microbiology, Virology, Immunology : textbook : Vol. 2. : учебник / Zverev V.V.; Boichenko M.N. - Москва : ГЭОТАР-Медиа, 2020. - 392 с. - ISBN 978-5-9704-5719-1., <https://e-lib.unn.ru/MegaPro/UserEntry?Action=FindDocs&ids=735471&idb=0>.

3. Generalov I. I. Instructions for Laboratory Training in General Microbiology & Immunology / Generalov I. I., Frolova A. V., Zheleznyak N. V. - Витебск : ВГМУ, 2023. - 38 с. - Книга из коллекции ВГМУ - Медицина., <https://e-lib.unn.ru/MegaPro/UserEntry?Action=FindDocs&ids=883843&idb=0>.

Программное обеспечение и Интернет-ресурсы (в соответствии с содержанием дисциплины):

online resource Anil K. Sharma. Medical Microbiology. - De Gruyter, 2022. - <https://e-lib.unn.ru/MegaPro/UserEntry?Action=FindDocs&ids=857334&idb=0>

Medical Microbiology, Virology and Immunology. Lecture Notes <https://e-lib.unn.ru/MegaPro/UserEntry?Action=FindDocs&ids=869428&idb=0>

Zverev V.V. Medical Microbiology, Virology, Immunology : textbook. Vol. 1 : учебник <https://e-lib.unn.ru/MegaPro/UserEntry?Action=FindDocs&ids=809236&idb=0>

Zverev V.V. Medical Microbiology, Virology, Immunology : textbook : Vol. 2. : учебник <https://e-lib.unn.ru/MegaPro/UserEntry?Action=FindDocs&ids=735471&idb=0>

7. Материально-техническое обеспечение дисциплины (модуля)

Учебные аудитории для проведения учебных занятий, предусмотренных образовательной программой, оснащены мультимедийным оборудованием (проектор, экран), техническими средствами обучения, компьютерами, специализированным оборудованием: Classrooms for conducting classes provided for by the educational program are equipped with multimedia equipment (projector, screen), technical training aids. Rooms for independent work of students are equipped with computer equipment with the ability to connect to the Internet and are provided with access to the electronic information and educational environment.

Помещения для самостоятельной работы обучающихся оснащены компьютерной техникой с возможностью подключения к сети "Интернет" и обеспечены доступом в электронную информационно-образовательную среду.

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