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**MINISTRY OF EDUCATION AND SCIENCE OF RUSSIA**

**Federal State Budgetary Educational Institution  
of higher education**

**«I.N. Ulianov Chuvash State University»**

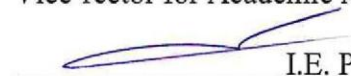
**(FSBEI of HE «I.N. Ulianov Chuvash State University»)**

Medical Faculty

Department of Medical Biology with a course of Microbiology and Virology

«APPROVE»

Vice-rector for Academic Affairs

  
I.E. Poverinov

« 13 » 04 2022

**Working programs of the discipline (module)  
«Микробиология, вирусология / Microbiology, Virology»**

Direction of training / specialty 31.05.03 Стоматология / Dentistry

Graduate's qualification Врач-стоматолог / Dental Practitioner

Direction (profile) / specialization «Dentistry»

Form of training – очная / intramural

Course – 2

Term – 3, 4

Total academic hours/credit points – 180/5

The year of beginning the training – 2022

The fundamental document for compiling the working program of the discipline (module)  
Федеральный государственный образовательный стандарт высшего образования -  
специалитет по специальности 31.05.03 Стоматология (приказ Минобрнауки России от  
12.08.2020 г. № 984)

Approved by:

Associate Professor Candidate of Biological Sciences N.V. Nalimova

The working program was approved at the meeting of the Department of Medical Biology  
with a course of Microbiology and Virology,  
22.03.2022, protocol № 7

Head of the department N.V. Smirnova

Approved by

Dean of the Medical Faculty V.N. Diomidova

Acting Head of the Educational and Methodological Department E.A. Shirmanova

## **1. The purpose and objectives of training in the discipline (module)**

The purpose of the discipline - mastering students of the theoretical foundations and patterns of interaction between microorganism and macroorganism, practical skills in methods of prevention, microbiological, molecular-biological and immunological diagnosis, the basic directions of treatment of pathogenic and opportunistic human infectious diseases.

The objectives of the discipline - - formation of students' general ideas about the structure and functioning of microbes as living systems, their role in ecology and decontamination methods, including the basics of disinfectology and sterilization techniques;

- mastering by students of ideas about the patterns of interaction of the human body with the microbial world, including modern ideas about the immune response to infectious and non-infectious agents (antigens);

- the study of the principles and methods of the results interpretation obtained in the conduct of microbiological, molecular-biological and immunological researches of biological specimens, virus-containing samples and microbial pure cultures;

- training in methods of carrying out preventive measures to prevent bacterial, fungal, parasitic and viral diseases;

- the study of the basic treatment directions of human pathogenic and opportunistic infectious diseases (bacterial, fungal, protozoan, viral, prion);

- development of students' skills in working with scientific literature;

- acquaintance with the principles of organizing work in a microbiological laboratory, with measures for labor protection and safety;

- formation of students' ideas about the storage conditions of chemical reagents and drugs.

## **2. The place of practical training in the structure of the educational program of higher education**

The discipline «Микробиология, вирусология / Microbiology, Virology» относится к обязательной части учебного плана refers to the mandatory part in the curriculum of the educational program of higher education (hereinafter referred to as the EP of HE) in the field of training / specialty 31.05.03 Стоматология, direction (profile) / specialization of the program «Dentistry».

Previous academic disciplines (modules) and (or) practices that form the knowledge, skills and abilities necessary for training in the discipline (module):

Анатомия / Anatomy

Гистология, эмбриология, цитология / Histology, Embryology, Cytology

Биология / Biology

Безопасность жизнедеятельности / Health and Safety

Латинский язык / The Latin Language

Knowledge, skills and abilities formed as a result of training in a discipline (module) are necessary when teaching in the following disciplines (modules) and (or) practices:

Иммунология / Immunology

Пропагандистическая стоматология / Propaedeutic Dentistry

Пропагандистика внутренних болезней / Propaedeutics of Internal Diseases

Валеология / Valeology

Терапевтическая стоматология / Therapeutic Dentistry

Хирургическая стоматология / Surgical Dentistry

Внутренние болезни / Internal Diseases

Гигиена / Hygiene

Инфекционные болезни, эпидемиология / Infectious Diseases, Epidemiology  
 Топографическая анатомия и оперативная хирургия головы и шеи / Topographic Anatomy and Operative Surgery of the Head and Neck  
 Нормальная физиология / Normal Physiology  
 Профилактическая стоматология / Preventive Dentistry  
 Патологическая анатомия / Pathological Anatomy  
 Производственная практика (практика по получению профессиональных умений и опыта профессиональной деятельности (по профилактической стоматологии)) / On- the-job training (practical training in obtaining professional skills and professional experience (in surgical dentistry))

**3. Planned learning outcomes in the discipline (module), correlated with the planned learning outcomes**

Planned learning outcomes in the discipline (module), correlated with the planned learning outcomes

Code and name of the competence	Code and name of the competence achievement	Descriptors for the indicator of competence achievement (learning)
ОПК-9 Способен оценивать морфофункциональные, физиологические состояния и патологические процессы в организме человека для решения профессиональных задач / He/she is able to evaluate morphofunctional, physiological states and pathological processes in the human body to solve professional problems	ОПК-9.1 Способен распознавать морфофункциональные, физиологические состояния и патологические процессы в организме человека / He/she is able to recognize morphofunctional, physiological states and pathological processes in the human body	Basic principles for diagnostic of infectious diseases, medical indications for hospitalization of patients with infectious diseases. Etiology, pathogenesis and diagnostics of the most common infectious diseases.  Identify common and specific signs of dental diseases Development of an algorithm for establishing a preliminary diagnosis. Establishing a preliminary diagnosis Referral of patients for laboratory testing
ОПК-9 Способен оценивать морфофункциональные, физиологические состояния и патологические процессы в организме человека для решения профессиональных задач / He/she is able to evaluate morphofunctional, physiological states and pathological processes in the human body to solve professional problems	ОПК-9.2 Способен анализировать морфофункциональные, физиологические состояния и патологические процессы в организме человека / He/she is able to analyze morphofunctional, physiological states and pathological processes in the human body	Clinical picture, diagnostic methods, classification of the infectious diseases of the teeth, periodontium, oral mucosa and lips. Clinical picture, diagnostic methods, classification of the infectious diseases of the bone tissue of the jaws, peripheral nervous system of the maxillofacial region and temporomandibular joint.  Analyze the results of the patient's examination Interpretation of laboratory data

ОПК-9 Способен оценивать морфофункциональные, физиологические состояния и патологические процессы в организме человека для решения профессиональных задач / He/she is able to evaluate morphofunctional, physiological states and pathological processes in the human body to solve professional problems	ОПК-9.3 Способен диагностировать морфофункциональные, физиологические состояния и патологические процессы организма человека / He/she is able to diagnose morphofunctional, physiological states and pathological processes in the human body	The purpose of special and additional research methods for the differential diagnosis of the dental infectious diseases Diagnosis of dental caries, the infectious diseases of pulp, periodontium, gum and oral mucosa. Interpretation of laboratory data  Development of an algorithm for establishing a final diagnosis Establishing a final diagnosis
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#### 4. Structure, scope and content of the discipline (module)

Educational activities in the discipline (module) are carried out:

- in the form of students' face-to-face work with the teaching staff of the organization and (or) persons involved by the organization to implement the educational programs on other terms (hereinafter - contact work);

- in the form of students' independent work.

Face-to-face work can be classroom-based, extramural, as well as it can be conducted in an electronic information and educational environment (EIEE).

Learning sessions in the discipline (module) and interim assessment of students are conducted in the form of face-to-face work and in the form of students' independent work.

During learning sessions in the discipline (module) face-to-face work includes: lecture-type classes, seminar-type classes and (or) group consultations, and (or) individual work of students with the teaching staff of the organization and (or) persons involved by the organization to implement the educational programs on other terms (including individual consultations).

Legend:

Lec – lectures, Lab – laboratory work, Pr – practical classes, ICW – individual face-to-face work, IW – independent work.

#### 4.1. Content of the discipline (module)

Section name	The section's content	Formed competences	Competence achievement indicator
1 Classification, morphology, physiology and ecology of microorganisms.	Subject of «Microbiology, virology». Historical development of microbiology	ОПК-9	ОПК-9.1, ОПК-9.2, ОПК-9.3
	Acquaintance with the microbiological laboratory equipment. Microbiological research methods.		
1 Classification, morphology, physiology and ecology of	Classification and morphology of microorganisms, microbial		

microorganisms.	taxonomy. Bacterial cell structures. Diagnostic methods for detection of the bacterial cell structures: microscopy and staining techniques.		
1 Classification, morphology, physiology and ecology of microorganisms.	Microbial physiology.	ОПК-9	ОПК-9.1, ОПК-9.2, ОПК-9.3
	The influence of physical and chemical factors on microbes. Microbial ecology (microecology). Human-microbes symbiosis (endoecology).		
2 General virology. Microorganisms genetics. Infectious process. Antimicrobial and immunobiological drugs.	General virology.		
	Microorganisms genetics.		
	Concept of infection.		
3 Private bacteriology.	Causative agents of the upper respiratory tract infections. Manifestations of the bacterial infections in the oral cavity.		
	Causative agents of the wound infections. Causative agents of non- clostridial anaerobic infections. Manifestations of the bacterial infections in the oral cavity.		
	Causative agents of the intestinal infections.		
	Causative agents of the external integuments and mucous membranes infections		
4 Private virology.	Causative agents of viral infections.		

#### 4.2. Scope of the discipline and types of academic work

Forms of control and types of academic work		Labor intensity of the discipline (module)		
		3	4	total
1. Face-to-face work:		48	32,3	80,3
In-class learning in total, including:		48	32	80
Лекционные занятия (Лек)		16	16	32
Лабораторные занятия (Лаб)		32	16	48
Индивидуальная контактная работа (ИКР)			0,3	0,3
2. Independent work of the student:		24	39,7	63,7
3. Intermediate certification (exam) (экзамен)			Эк	
Total:	academic hours	72	108	180
	credit units	2	3	5

№ item	The section's (theme's) name	Face-to face work, including in the electronic information and educational environment, academic hours				IW, academic hours	Total, academic hours
		Lect.	Pr.	Lab.	ICW		
	1 Classification, morphology, physiology and ecology of microorganisms.						
1	Subject of «Microbiology, virology». Historical development of microbiology	2				2	4
2	Acquaintance with the microbiological laboratory equipment. Microbiological research methods.			2		1	3
3	Classification and morphology of microorganisms, microbial taxonomy. Bacterial cell structures. Diagnostic methods for detection of the bacterial cell structures: microscopy and staining techniques.	4		6		4	14
4	Microbial physiology.	2		4		2	8

5	The influence of physical and chemical factors on microbes. Microbial ecology (microecology). Human-microbes symbiosis (endoecology).	2		6		6	14
	2 General virology. Microorganisms genetics. Infectious process. Antimicrobial and immunobiological drugs.						
6	General virology.	2		4		4	10
7	Microorganisms genetics.	2		4		2	8
8	Concept of infection.	2		6		3	11
	3 Private bacteriology.						
9	Causative agents of the upper respiratory tract infections. Manifestations of the bacterial infections in the oral cavity.	4		4	0,3	8,7	17
10	Causative agents of the wound infections. Causative agents of non-clostridial anaerobic infections. Manifestations of the bacterial infections in the oral cavity.	2		2		5	9
11	Causative agents of the intestinal infections.	2		2		2	6
12	Causative agents of the external integuments and mucous membranes infections	2		2		6	10
	4 Private virology.						
13	Causative agents of viral infections.	6		6		18	30
Total academic hours		32		48	0,3	63,7	180

### 4.3. Summary of the discipline (module), structured by sections (topics)

#### Раздел 1. 1 Classification, morphology, physiology and ecology of microorganisms.

##### Тема 1. Subject of «Microbiology, virology». Historical development of microbiology

Лекционное занятие. Medical microbiology. Subject, methods, tasks. Classification of microorganisms.

##### Тема 2. Acquaintance with the microbiological laboratory equipment. Microbiological research methods.

Лабораторное занятие. Acquaintance with the microbiological lab equipment. Microbiological research methods. Bacterial morphology.

**Тема 3. Classification and morphology of microorganisms, microbial taxonomy. Bacterial cell structures. Diagnostic methods for detection of the bacterial cell structures: microscopy and staining techniques.**

Лекционное занятие. Classification and morphology of microorganisms, microbial taxonomy. Bacterial cell structures.

Лекционное занятие. The structure and morphology of spirochetes, actinomycetes and fungi. The morphology and structure of micoplasmas, chlamydia, rickettsia and protozoa.

Лабораторное занятие. The morphology and structure of the bacterial cell. Diagnostic methods to detection of the bacterial cell structures: simple (Burri or negative staining) and differential staining techniques: Gram staining, Burri-Hins staining, Neisser staining, Ziehl-Neelsen staining and Ozheshki staining.

Лабораторное занятие. The structure and morphology of spirochetes, actinomycetes, fungi and protozoans.

Лабораторное занятие. The morphology and structure of mycoplasmas, Chlamydia and rickettsiae.

**Тема 4. Microbial physiology.**

Лекционное занятие. Microbial physiology. Nutrition and respiration of the bacteria. Bacterial culturing and their identification.

Лабораторное занятие. Microorganisms nutrition. Growth and reproduction of the bacteria. Culture media. Stages of the bacteria culturing. Methods of isolating the bacterial pure cultures with aerobic respiration.

Лабораторное занятие. Features of isolating pure cultures of aerobic and anaerobic bacteria. Enzymatic activity of microbes. Identifying bacteria to their biochemical characteristics.

**Тема 5. The influence of physical and chemical factors on microbes. Microbial ecology (microecology). Human-microbes symbiosis (endoecology).**

Лекционное занятие. The influence of environmental factors on microorganisms. Sterilization. Microflora of water, soil and air. Human's body microbiota. Dysbiosis. Eubiotics.

Лабораторное занятие. The effect of physical environmental factors on microorganisms. Sterilization. Microflora of water, soil and air. Methods of sanitary- bacteriological study of the water, air and soil. Sanitary-indicative microorganisms.

Лабораторное занятие. Human's body microbiota. Eubiosis and dysbiosis. Eubiotics.

Лабораторное занятие. Oral cavity's microbiota.

**Раздел 2. 2 General virology. Microorganisms genetics. Infectious process. Antimicrobial and immunobiological drugs.**

**Тема 6. General virology.**

Лекционное занятие. Classification and structure of viruses. Virus-host cell interactions. Methods of viruses cultivating. Bacteriophages, their structure, properties and application.

Лабораторное занятие. Classification and structure of viruses. Virus-host cell interactions. Viruses reproduction. Methods of viruses cultivating. Viruses's cytopathic effects.

Лабораторное занятие. Bacteriophages, their structure, properties and application. Bacteriophage activity determination.

**Тема 7. Microorganisms genetics.**

Лекционное занятие. Microorganisms genetics. Organization of genetic material in the microorganisms. Molecular-genetic methods. Genetic engineering.

Лабораторное занятие. Microorganisms genetics. Organization of genetic material in bacteria, genotype, phenotype. Extrachromosomal factors of heredity: plasmids, transposons and insertion sequences. Mutation. Genetic recombinations: conjugation, transduction, transformation.

Лабораторное занятие. Phenotypic variation. R-S - dissociation. Bacteriocins concept. Molecular-genetic methods. Genetic engineering.

**Тема 8. Concept of infection.**

Лекционное занятие. Infection. Antimicrobial drugs. Immunobiological drugs: vaccines, sera.

Лабораторное занятие. Infection. Source and modes of infection transmission. Pathogenic microorganisms: pathogenicity, virulence. Virulence factors. Microbial mechanisms of pathogenicity. Classification of infections. The dynamics of the infectious process. Diagnostic animal test.

Лабораторное занятие. Antimicrobial drugs, mechanisms of their action. Mechanisms for drug resistance. Antimicrobial susceptibility tests. Antiviral drugs, mechanisms of their action.

Лабораторное занятие. Immunobiological drugs: vaccines, sera. Immunological reactions and assays.

### **Раздел 3. 3 Private bacteriology.**

#### **Тема 9. Causative agents of the upper respiratory tract infections. Manifestations of the bacterial infections in the oral cavity.**

Лекционное занятие. Bacterial causative agents of the upper respiratory tract infections: staphylococci, streptococci, meningococci. Manifestations of the bacterial infections in the oral cavity.

Лекционное занятие. Causative agents of tuberculosis, diphtheria, pertussis and actinomycosis. Manifestations of these infections in the oral cavity. Microbiological diagnosis of these diseases.

Лабораторное занятие. Microbiological diagnosis of staphylococcal, streptococcal and meningococcal infections.

Лабораторное занятие. Microbiological diagnosis of tuberculosis, diphtheria, pertussis and actinomycosis.

#### **Тема 10. Causative agents of the wound infections. Causative agents of non-clostridial anaerobic infections. Manifestations of the bacterial infections in the oral cavity.**

Лекционное занятие. Causative agents of clostridial wound infections and non-clostridial infections. Manifestations of non-clostridial infections in the oral cavity. Microbiological diagnosis of these diseases.

Лабораторное занятие. Microbiological diagnosis of clostridial wound infections and non-clostridial infections. Manifestations of non-clostridial infections in the oral cavity.

#### **Тема 11. Causative agents of the intestinal infections.**

Лекционное занятие. Family Enterobacteriaceae and vibrios. Microbiological diagnosis of the intestinal bacterial infections.

Лабораторное занятие. Microbiological diagnosis of the bacterial intestinal infections.

#### **Тема 12. Causative agents of the external integuments and mucous membranes infections**

Лекционное занятие. Causative agents of the external integuments and mucous membranes infections: gonorrhoea, syphilis, urogenital chlamydiosis and candidiasis. Manifestations of infections in the oral cavity.

Лабораторное занятие. Causative agents of the external integuments and mucous membranes infections: gonorrhoea, syphilis, urogenital chlamydiosis and candidiasis. Manifestations of infections in the oral cavity. Microbiological diagnosis of these diseases.

### **Раздел 4. 4 Private virology.**

#### **Тема 13. Causative agents of viral infections.**

Лекционное занятие. Causative agents of the acute viral respiratory infections. Manifestations of infections in the oral cavity. Virological diagnosis of these diseases.

Лекционное занятие. Herpes viruses. Hepatotropic viruses. Human immunodeficiency virus (HIV). Manifestations of infections in the oral cavity. Virological diagnosis of the diseases they cause.

Лекционное занятие. Viral causative agents of intestinal and nervous system infections: picornaviruses (enteroviruses), rotaviruses, rabdoviruses. Manifestations of infections in the oral cavity. Virological diagnosis of the diseases they cause.

Лабораторное занятие. Causative agents of the acute viral respiratory infections. Manifestations of infections in the oral cavity. Virological diagnosis of these diseases.

Лабораторное занятие. Herpes viruses. Hepatotropic viruses. Human immunodeficiency virus (HIV). Virological diagnosis of the diseases they cause.

Лабораторное занятие. Viral causative agents of intestinal and nervous system infections: picornaviruses (enteroviruses), rotaviruses, rabdoviruses. Virological diagnosis of the diseases they cause.

## **5. Educational technologies**

To implement the competence-based approach in the study of the discipline (module), extensive use of active and interactive methods of conducting classes in the educational process is provided:

The constituent elements of educational technologies are:

- lectures - to present new material,
- laboratory classes - conducted in the educational microbiological laboratory using modern methods of isolation and diagnosis of microorganisms using light microscopes, micropreparations, macropreparations, tabular material;
  - applying of multimedia equipments (projector, screen, TV, personal computer or laptop)
- to improve quality of perception of the studied material;
  - educational videos
  - controlled homeworks - to motivate students to work independently;
  - control tests - for intermediate certification and assessment of the degree of assimilation by students of the material passed.

## **6. Forms of control and types of evaluation materials for the discipline (module)**

Intermediate attestation - evaluation of intermediate and final results of training in the discipline (module).

### **6.1. Sample list of questions for the credit test**

Not provided

### **6.2. Sample list of questions for the examination**

1. Medical microbiology, the subject and tasks of its study.
2. Microscope invention and microbes discovery. Antony van Leeuwenhoek.
3. Founders of microbiology as a scientific discipline: Louis Pasteur, Robert Koch.
4. Viruses discovery by Dmitry Iwanowski, the value of this discovery for

biology and medicine.

5. The works of Elie Metchnikoff and of Paul Ehrlich, their meaning.
6. Microbiological laboratory and lab equipment. Working rules in the microbiological laboratory.
7. Diagnostic methods used for identifying and classifying bacteria.
8. Light microscopy: bright-field (light), dark-field, phase-contrast, and fluorescent microscopy. Electron microscopy.
9. The technique of preparing smears and preparations. Native and stained preparations. Positive stain. Negative stain.
10. Aniline dyes and their use in microbiology. Simple and differential staining techniques.
11. Gram staining. The steps of the Gram stain procedure.
12. Ziehl-Neelsen staining.
13. Neisser staining.
14. Silver impregnation staining and Giemsa staining.
15. Microorganisms classification. The main differences between prokaryotes and eukaryotes.
16. Principles of bacterial classification. Bergey's Manual of Determinative Bacteriology. Serovar, phageovar. Culture, colony, strain, clone.
17. Bacterial morphology. Bacteria with a cell wall (cocci, rods, curved shaped) and not having a cell wall.
18. Bacterial cell structures: obligatory organelles (nucleoid, cytoplasm, cytoplasmic membrane, mesosome, cell wall, ribosome) and optional organelles (plasmids, flagella, capsule, endospore, fimbriae and pili).
19. The structure of cell wall. Cell wall-defective bacteria: protoplasts, spheroplasts, L-forms.
20. Bacterial spores and sporulation in bacteria. Ozheshki staining.
21. Bacterial capsules. Burry-Hins and negative staining.
22. Bacterial motility and methods of its study. Loeffler staining.
23. Classification, morphology and structure of actinomycetes.
24. Classification, morphology and structure of spirochetes.
25. Classification, morphology and structure of mycoplasmas.
26. Classification, morphology and structure of rickettsia.
27. Classification, morphology and structure of chlamydia.
28. Classification, morphology and structure of fungi.
29. Classification, morphology and structure of protozoans.
30. Microorganisms nutrition types. Growth factors.
31. Bacterial aerobic and anaerobic respiration. Obligate aerobe, obligate anaerobe and facultative anaerobe.
32. Microbial enzymes, their classification.
33. Growth of microorganisms on liquid and solid culture media. Microorganisms reproduction. Bacterial division. Phases of bacterial culture growth curve.
34. Conditions required for bacterial cultivation or growth. Uncultivated forms of bacteria.
35. Culture media, their classification. Enrichment, selective and differential/indicator media.
36. Steps of bacteria culturing in vitro. Identification of bacteria.
37. Cultural (or colonies) characteristics. Bacterial count.
38. Biochemical reactions. Sugar fermentation test. Tests for fermentation of protein and amino acids.
39. Methods of isolating bacterial pure cultures with aerobic respiration.
40. Anaerobic culturing methods. Features of isolating bacterial pure cultures

with anaerobic respiration.

41. The influence of environmental factors on microbes. Microbial communities. Relationships of microorganisms.

42. Sterilization and disinfection methods.

43. Microflora of water. Sanitary-indicator microbes. Methods of the sanitary quality examination of water.

44. Microflora of soil. Sanitary-indicator microbes. Methods of the sanitary quality examination of soil.

45. Microflora of air. Sanitary-indicator microbes. Methods of the sanitary quality examination of air.

46. Human's body microbiota: resident microbiota and transient microbiota, its value (beneficial and harmful effects).

47. Characteristic of human's body microbiota at various sites (skin, upper respiratory tract, gastrointestinal tract, genital tract, conjunctiva).

48. Eubiosis and dysbiosis. Laboratory diagnosis, correction and prevention of dysbiosis. Approaches to the normalization of dysbiosis: eubiotics (probiotics), prebiotics and bacteriophages.

49. General characteristics of the oral microbiota.

50. Microbiota of the oral cavity main biotopes: mucous membrane, salivary glands, gingival crevice and gingival fluid, saliva and dental plaque. Immune defense.

51. Biofilm (=dental plaque), tartar (=dental calculus), and dental caries. The mechanisms and role of oral microorganisms of their formation. Cariogenic *Streptococcus mutans*, its characteristic.

52. Formation of periodontal diseases (gingivitis and periodontitis). Prevention of the dental diseases. Oral cavity hygiene.

53. Classification, properties and structure of viruses. Virions chemical composition.

54. Viruses replication. Virus-host cell interactions. The steps of viral life cycle.

55. Methods of viruses cultivation. Indication and identification of viruses. Cytopathic effect of viruses in cell culture.

56. Bacteriophage, its main properties. Phage interaction with the bacterial cell. Bacteriophages life cycles: lytic and lysogenic cycle. Lysogenic conversion.

57. Obtaining of bacteriophages. Bacteriophages activity determination.

58. Bacteriophage using. Phage typing. Temperate phage as a cloning vector.

59. Prions, their structure and properties.

60. The organization of genetic material in bacteria. Chromosomal DNA. Genotype. Phenotype. Bacterial genome maps.

61. Extrachromosomal genetic elements: plasmids, transposons, insertion sequences (IS). Plasmid classification and functions.

62. Mutations, their classification. Physical, chemical and biological mutagens. Reparations.

63. Genetic recombinations: conjugation, transformation, transduction.

64. Phenotypic variation or modifications. R-S - dissociation.

65. Bacteriocins concept.

66. Using of molecular methods to microbial DNA/RNA identification: nucleic acid probing, polymerase chain reaction, restriction fragment polymorphism analysis.

67. Genetic engineering, its application in medicine.

68. Infection. Chains of the infectious process.

69. Definition, conditions for the infection occurrence. Pathogens types. Sources and modes of infection transmission.

70. Pathogenesis stages.

71. Classification (types or forms) of infection and their characteristics.

72. Infectious disease periods.

73. Pathogenicity, virulence and toxicity of microorganisms.

74. Virulence factors (=determinants of virulence) of microbial pathogens: surface structural sub-stances and exoenzymes. Adhesins. Invasins. Aggressins. Modulins.

75. Characteristic of bacterial toxins: exotoxins and endotoxin.

76. Genetic control of virulence and toxin formation.

77. Diagnostic animal tests.

78. Antimicrobial drugs. Classification by origin and mechanisms of action.

79. Mechanisms of antimicrobial drug resistance and ways to overcome.

80. Antimicrobial resistance (=sensitivity) tests. Disc diffusion tests on agar plate (Kirby-Bauer, Stokes, primary disc diffusion method) and tube dilution series tests. Minimum inhibitory concentration (MIC).

81. Antiviral drugs, mechanisms of their action.

82. Active immunization. Vaccines classification. Toxoids. Their production and use.

83. Passive immunization. Sera and immunoglobulins. Antisera, their use.

84. Direct and indirect immunological diagnosis. Immunological reactions and assays to detecting antigen-antibody complexes: agglutination assay, hemagglutination and hemagglutination inhibition assays, precipitation assay, complement fixation test, neutralization assay, enzyme immunoassay, immunofluorescence tests.

85. Staphylococci, classification, their properties, pathogenesis, features of treatment, prevention and microbiological diagnosis of staphylococcal infections. Manifestations of these infections in the oral cavity. Multidrug resistance. Cariogenic cocci: Peptococcus, Peptostreptococcus, Veillonella.

86. Streptococci, classification, their properties, virulence factors, pathogenesis, features of treatment, prevention and microbiological diagnosis of streptococcal infections. Pneumonia. Scarlet fever: manifestations in the oral cavity. Role of oral cocci in the caries and dental plaques etiology.

87. Meningococci, classification, their properties, virulence factors, pathogenesis, features of treatment, prevention and microbiological diagnosis of meningococcal infections.

88. Causative agents of tuberculosis: classification, properties, virulence factors. Pathogenesis, features of treatment, prevention and microbiological diagnosis of tuberculosis. Manifestations in the oral cavity. Multidrug resistance.

89. Causative agents of diphtheria, their classification, properties, virulence factors. Pathogenesis, features of treatment, prevention and microbiological diagnosis of diphtheria. Manifestations in the oral cavity.

90. Causative agents of pertussis (or whooping cough): classification, properties, virulence factors; pathogenesis, features of treatment, prevention and microbiological diagnosis of pertussis.

91. Causative agents of actinomycosis: classification, properties, pathogenesis, features of treatment, prevention and microbiological diagnosis of actinomycosis. Manifestations in the oral cavity.

92. Causative agents of gas anaerobic infection: classification, properties, virulence factors. Pathogenesis, features of treatment, prevention and microbiological diagnosis of gas anaerobic infection.

93. Causative agents of tetanus, their properties, virulence factors; pathogenesis, features of treatment, prevention and microbiological diagnosis of tetanus.

94. Botulism pathogen: properties, virulence factors. Pathogenesis and microbiological diagnosis of botulism.

95. Causative agents of non-clostridial anaerobic infection: Bacteroides, Fusobacterium, Leptotrichia, Prevotella, Porphyromonas: classification, properties. Pathogenesis, microbiological diagnosis of the diseases they cause. Manifestations in the oral

cavity.

96. *Pseudomonas*: properties, virulence factors; pathogenesis, features of treatment, prevention and microbiological diagnosis of diseases caused by them. Multidrug resistance.

97. Enteropathogenic *Escherichia coli*, their properties, virulence factors. Antigenic structure of *Escherichia coli*. Pathogenesis, features of treatment, prevention and microbiological diagnosis of colienteritis.

98. *Salmonella* species are causative agents of typhoid fever and paratyphoid fever, their properties. Pathogenesis, features of treatment, prevention and microbiological diagnosis of typhoid fever and paratyphoid fever. Antigenic structure of salmonellae. Serological and biochemical identification of isolating pure culture. Serotyping by Kauffmann-White scheme.

99. Enteric salmonellae are causative agents of foodborne intoxication and nosocomial diseases. Pathogenesis, features of treatment, prevention and microbiological diagnosis of diseases caused by them.

100. *Shigella*, classification and properties. Pathogenesis, features of treatment, prevention and microbiological diagnosis of bacterial dysentery. *Proteus*, features of microbiological diagnosis.

101. *Vibrio cholera*, classification, properties, virulence factors. Pathogenesis, features of treatment, prevention and features of microbiological diagnosis of cholera.

102. Gonococci, classification, properties, virulence factors. Pathogenesis, features of treatment, prevention and microbiological diagnosis of gonorrhea and ophthalmic neonatorum (= blenorhea). Gonococcal stomatitis.

103. *Treponema*, classification, properties, virulence factors. Pathogenic and resident spirochetes. Pathogenesis, features of treatment, prevention and microbiological diagnosis of syphilis. Manifestations of syphilis in the oral cavity. Ulcerative-necrotic gingivostomatitis.

104. Chlamydia, classification, properties. Pathogenesis, features of treatment, prevention and microbiological diagnosis of urogenital chlamydiosis.

105. Yeast-like fungi *Candida*, classification, properties. Dimorphism. The risk factors associated with candidiasis, their manifestations in the oral cavity. Oral thrush. Pathogenesis, features of treatment, prevention and microbiological diagnosis of candidiasis.

106. Influenza viruses, their structure and properties. Antigenic variation. Pathogenesis, features of treatment and prevention of influenza. Viral diagnosis: detection and identification. Hemagglutination and hemagglutination inhibition tests.

107. Causative agents of acute respiratory viral infections: paramyxoviruses: parainfluenza viruses, respiratory syncytial viruses, measles viruses, mumps viruses; coronaviruses, adenoviruses, rhinoviruses, their structure and properties. Pathogenesis, features of treatment, prevention and diagnosis of diseases caused by them. Infection forms. Common cold, severe acute respiratory syndrome (SARS) and viral pneumonia. Causative agents of slow infections.

108. Rubiviruses, its structure and properties. Teratogenic effect of rubella virus. Pathogenesis, features of treatment, prevention and diagnosis of rubella.

109. Herpes viruses, its structure, classification, properties. Pathogenesis, features of treatment and diagnosis of infections caused by herpes viruses and herpes simplex viruses. Oncogenic herpes viruses as causative agents of malignancies. Herpetic gingivostomatitis.

110. Varicella-zoster virus, its properties. Pathogenesis and diagnosis of varicella or chickenpox and herpes zoster.

111. Hepatitis A and E viruses, their structure, properties. Pathogenesis and diagnosis of diseases caused by them.

112. Hepatotropic viruses: hepatitis B, C, D. viruses, their structure, properties.

Pathogenesis and diagnosis of diseases caused by them. Prevention of hepatitis B. Significance in the pathology of the maxillofacial region. Danger of infection in the dental office.

113. Human immunodeficiency viruses: structure and properties. Pathogenesis and clinical picture. Danger of infection in the dental office.

114. Picornaviruses (Enteroviruses) and rotaviruses, their structure. Polioviruses, coxsackieviruses, echoviruses and rotaviruses, their properties. Pathogenesis and diagnosis of diseases caused by them. Herpangina.

115. Rabdoviruses, its structure, properties. Pathogenesis and diagnosis of diseases caused by rabies virus and vesicular stomatitis virus.

116. Bacterial infections. Opportunistic infections. Bacterial infections of the oral cavity. Fungal infections.

117. Viral infections. Slow viral infections. Latent viral infections. Viral infections of the oral cavity.

118. Oncogenic viruses: general characteristics and classification. Mechanisms of viral carcinogenesis.

119. Slow prion or conformational infections.

120. Hospital-acquired or nosocomial infections.

### **6.3. Suggested themes of term papers (projects)**

Not provided

### **6.4. Suggested themes of term projects**

Not provided

### **6.5. Suggested topics of calculation and graphic works**

Not provided

## **7. Educational, methodological, informational and software support of the discipline (module)**

The electronic catalog and electronic information resources provided by the scientific library of the FSBEI of HE "I. N. Ulianov Chuvash State University" are available at the link <http://library.chvsu.ru/>

### **7.1. Regulatory documents, standards and rules**

Not provided

### **7.2. Recommended basic educational and methodological literature**

№ item	Name
1	Generalov I. I. Medical Microbiology, Virology and Immunology [Электронный ресурс]:. - Витебск: ВГМУ, 2017. - 670 с. – Режим доступа: <a href="https://www.books-up.ru/ru/read/medical-microbiology-virology-and-immunology-12077523/">https://www.books-up.ru/ru/read/medical-microbiology-virology-and-immunology-12077523/</a>

### **7.3. Recommended supplementary educational and methodological literature**

№ item	Name
1	

### **7.4. List of resources of the "Internet" information and telecommunication network**

№ item	Name	Link to the resource
1	Single window to educational resources	<a href="http://window.edu.ru">http://window.edu.ru</a>
2	Russian State Library	<a href="http://www.rsl.ru">http://www.rsl.ru</a>

3	Russian National Library	<a href="http://www.nlr.ru">http://www.nlr.ru</a>
4	Scientific Electronic Library "Cyberleninka"	<a href="http://cyberleninka.ru">http://cyberleninka.ru</a>

### **7.5. Software, professional databases, information and reference systems, electronic educational resources and electronic library systems**

Software, professional databases, information and reference systems provided by the Informatization Department of the FSBEI of HE "I.N. Ulianov Chuvash State University" are available for download at the link <http://ui.chuvsu.ru> //. The Unified Register of Russian programs for electronic computers and databases, including freely distributed ones, is available at the link [reestr.minsvyaz.ru/reestr](http://reestr.minsvyaz.ru/reestr) /.

#### **7.5.1. Licensed and freely distributed software**

Microsoft Windows operating System and/or Unix-like operating system and/or mobile operating system;

Office software packages:

Microsoft Office and/or LibreOffice  
and (or) OpenOffice and (or) analogues;

Browsers, including Yandex.Browser.

List of software:

#### **7.5.2. Lists of professional databases and (or) information reference systems and (or) electronic library systems and (or) electronic educational resources**

## **8. Material and technical support of the discipline**

Classrooms for lecture-type classes in the discipline are equipped with a teacher's automated workplace consisting of: a personal computer/laptop, multimedia equipment with a screen and (or) SMART interactive whiteboard/SMART TV.

The premises for students' independent work are equipped with computer equipment enabling to connect to the Internet and provide access to the electronic information and educational environment of the FSBEI of HE "I.N. Ulianov Chuvash State University".

№ item	Lesson type	Brief description and characteristics of the composition of installations, measuring and diagnostic equipment, computer equipment and experimental automation tools
1	ИКР	Учебная аудитория для занятий семинарского типа, текущего контроля и промежуточной аттестации. Оборудование: учебная доска, учебная мебель, мультимедийное оборудование (проектор, экран, компьютер), монокулярные микроскопы, микроскоп МИКМЕД-5

2	Лаб	Учебная аудитория для занятий семинарского типа, текущего контроля и промежуточной аттестации. Оборудование: учебная доска, учебная мебель, мультимедийное оборудование (проектор, экран, компьютер), монокулярные микроскопы, микроскоп МИКМЕД-5
3	Лек	Учебные аудитории для занятий лекционного типа, семинарского типа. Оборудование: учебная доска, учебная мебель, мультимедийное оборудование (проектор, экран, персональный компьютер или ноутбук с необходимым программным обеспечением для тематических иллюстраций и демонстраций, соответствующих программе дисциплины)
4	Ср	Учебная аудитория для занятий семинарского типа, текущего контроля и промежуточной аттестации. Оборудование: учебная доска, учебная мебель, мультимедийное оборудование (проектор, экран, компьютер), монокулярные микроскопы, микроскоп МИКМЕД-5
5	Экзамен	Учебная аудитория для занятий семинарского типа, текущего контроля и промежуточной аттестации. Оборудование: учебная доска, учебная мебель, мультимедийное оборудование (проектор, экран, компьютер), монокулярные микроскопы, микроскоп МИКМЕД-5

## 9. Means of adapting the discipline teaching to the needs of persons with physical conditions

If necessary, persons with physical conditions can be offered one of the following options for perceiving information, taking into account their individual psychophysical characteristics:

- 1) using e-learning and distance learning technologies.
- 2) using special equipment (enginery) and software in accordance with the students' health restrictions in the Training Centers for Persons with Disabilities and Physical Conditions (hereinafter referred to as special needs) available at the university.

In the course of training, if necessary, the following conditions are provided for persons with visual, hearing and musculoskeletal disorders:

- for persons with visual impairments: educational and methodological materials in printed form in enlarged font; in the form of an electronic document; in the form of an audio file (conversion of educational materials into audio format); in printed form in Braille; individual consultations involving a tactile interpreter; individual assignments and consultations.

- for people with hearing impairments: educational and methodological materials in printed form; in the form of an electronic document; video materials with subtitles; individual consultations involving a sign language interpreter; individual assignments and consultations.

- for persons with disorders of the musculoskeletal system: educational and methodological materials in printed form; in the form of an electronic document; in the form of an audio file; individual assignments and consultations.

## 10. Guidelines for students to perform independent work

The purpose of the student's independent work (IW) is to consolidate the theoretical

knowledge gained and to acquire practical skills in using and performing research of algorithms and data structures when designing application software programs. IW includes independent study of educational issues, preparation for laboratory classes, performing calculation and graphic work, preparation for a test and an exam.

The list of questions and tasks for independent work to prepare for laboratory classes is given in the corresponding methodological instructive regulations in the description of each laboratory work.

The list of questions and tasks for independent work to carry out calculation and graphic work is given in the relevant methodological instructive regulations.

Independent work of students is an integral part of the educational process. The goal of independent work is the preparation of a modern competent specialist and the formation of abilities and skills for continuous self-education and professional development.

The implementation of this goal involves the following tasks:

- high-quality mastering of theoretical material on the studied discipline, deepening and expansion of theoretical knowledge with a view to their application at the level of interdisciplinary connections;

- systematization and consolidation of the received theoretical knowledge and practical skills;

- formation of skills in the search and use of normative, reference and special literature, as well as other sources of information;

- development of cognitive abilities and activity, creativity, independence, responsibility and organization;

- formation of independence of thinking, abilities to self-development, self-education, self-improvement and self-realization;

- development of scientific-research skills;

- formation of the ability to solve practical tasks (in professional activities), using the acquired knowledge, abilities and skills.

Independent work is determined by the specifics of the discipline and the method of its training, the time provided by the curriculum, as well as the level of training at which the discipline is studied. The main forms of organization of independent work of students are: independent work in classroom under the guidance and supervision of a teacher (in lectures, laboratory classes and consultations); independent extracurricular work under the direction and control of a teacher (during consultations, during research work), independent extracurricular work without the direct participation of a teacher (preparation for classes in classroom, Olympiads, conferences, performance of examinations, work with electronic information resources, preparation for exams and tests). Independent work of students is provided by these guidelines.

Independent extracurricular work is the planned educational, educational and research, research work of students, performed in extracurricular time on the instructions and with the teacher's methodological guidance, but without his direct participation. The purpose of independent work of students is to master the fundamental knowledge, professional skills and abilities.

## **11. Methodological instructive regulations for students studying the discipline (module)**

Topics submitted for independent study must be outlined. The summary briefly outlines the main essence of the educational material, provides the necessary justifications, tabular data, diagrams, etc. It is advisable to make a summary as a whole on the topic. At the same time, it is always possible to supplement the compiled summary with clippings and extracts from magazines, newspapers, articles, new textbooks, brochures on the exchange of experience, data from the Internet and other sources. Thus, the abstract becomes a collection

of necessary materials, where the student brings everything new that he has studied and learned. Such notes are of great value in preparing for classes.

The main stages of independent study of educational issues:

1. Initial acquaintance with the material of the topic under study in the text of the textbook, maps, additional literature.
2. Highlighting the main thing in the material being studied, compiling the usual brief notes.
3. Thinking over a schematic way of coding knowledge, using a different font, etc.
5. Drawing up a basic abstract.

#### **11.1. Methodological instructive regulations for preparing for seminar-type classes**

Not provided

#### **11.2. Methodological instructive regulations for preparing for an examination**

For self-preparation for the exam, the following sources can be recommended:

- lecture notes and materials of laboratory classes;
- educational literature of the relevant profile.

#### **11.3. Methodological instructive regulations for preparing for a test**

#### **11.4. Methodological instructive regulations for performing computational and graphical**

#### **11.5. Methodological instructive regulations for performing a control work**

#### **11.6. Methodological instructive regulations for performing a course work (project)**

### List of additions and changes

The name and details (if any) of the document attached to the Working Program of the discipline (module) containing the text of updates	Department's decision		Full name of department head:
	Date	Protocol №	