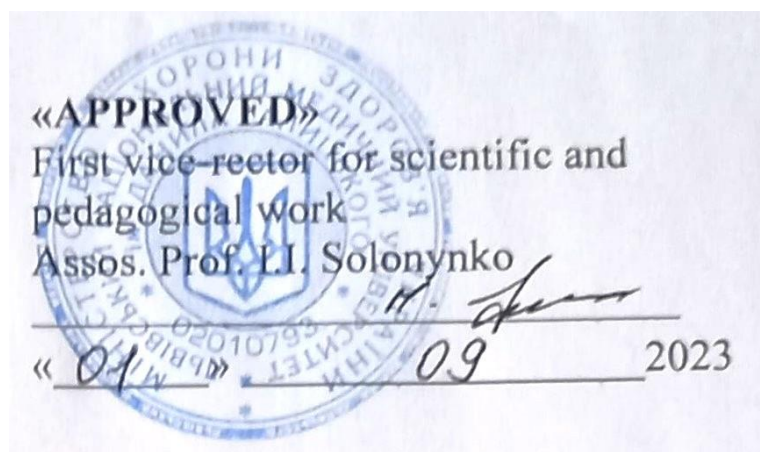


**MINISTRY OF HEALTH OF UKRAINE**  
**Danylo Halytsky Lviv National Medical University**  
**Department of Microbiology**



**EDUCATION CURRICULUM OF DISCIPLINE**  
**OK14**  
**"Microbiology, virology and immunology, including oral**  
**microbiology"**

for training specialists  
of the second (master's) level of higher education field  
of study - 22 "Health Care",  
specialty 221 "Dentistry" for second-year students

Discussed and **approved**  
at the methodical meeting of  
Department of Microbiology  
Protocol № 14  
Dated "09 June" 2023  
Head of the Department

prof. Olena KORNIYCHUK, MD

**Approved at the sitting of the cycle**  
the profile methodical commission  
in Preventive Medicine  
Protocol №4  
Dated 09" "June 2023  
Head of the profile methodical  
commission

prof. Vira FEDORENKO.MD

## PROGRAM DEVELOPERS:

*Korniychuk O.P., Head of the Department of Microbiology, Danylo Halytskyi Lviv Medical University, Ph. of Medical Sciences, Professor*

*Shykula R.G., Associate Professor of the Department of Microbiology, Danylo Halytsky Lviv Medical University, PhD, Associate Professor;*

*Nemchenko O.O., Associate Professor of the Department of Microbiology, Danylo Halytskyi Lviv Medical University, PhD, Associate Professor;*

*Pavliy S.Y. Associate Professor of the Department of Microbiology, Danylo Halytsky Lviv Medical University, PhD in Biology, Associate Professor.*

## REVIEWERS :

*Vinograd N. O., Head of the Department of Epidemiology, Danylo Halytsky Lviv National Medical University, Doctor of Medicine, Professor;*

*Fedorenko V.I., Head of the Department of Hygiene with a course in ecology at the Lviv National Medical Danylo Halytskyi National University, Doctor of Medicine, Professor.*

## INTRODUCTION

### **Program of study of the discipline "Microbiology, virology and immunology, including oral microbiology"**

in accordance with the educational and professional program "Dentistry"  
Standard of higher education of the *second (master's) level*  
field of knowledge 22 "Health care" specialty  
221 "Dentistry"

#### **Description of the subject (summary) OK (EC) 14 "Microbiology, virology, immunology, including oral microbiology"**

Microbiology, virology and immunology as an academic discipline:

- a) is based on the knowledge gained by students in the study of medical biology, medical and biological physics, biological chemistry, biological and bioorganic chemistry, histology, cytology and embryology, physiology and is integrated with these disciplines;
- b) lays the foundation for students to study general hygiene, epidemiology, pathological physiology, pathological anatomy, immunology and allergology, infectious diseases, internal diseases, surgical diseases and pediatric diseases and other clinical disciplines, which involves the integration of teaching with these disciplines and the development of skills to apply knowledge of microbiology, virology and immunology in the process of further education and professional activity;
- c) lays the foundations of the doctrine of the physiological role of microbes in the human body and the prevention of disruption of these functions in the process of medical interventions.

The academic discipline "Microbiology, Virology, Immunology, including Oral Microbiology" is represented by two content modules:

Content module 1: Morphology and physiology of microorganisms. Genetics of microorganisms. Antibiotics. Infection.

Immunity. Vaccines and immune serums. Sanitary microbiology.

Content module 2. Special, clinical microbiology. General and special virology

According to the curriculum, the types of academic knowledge are: a) lectures, b) practical classes, and c) independent work of students.

The topics of the lecture course reveal the problematic issues of the relevant sections of microbiology.

Practical classes are laboratory classes in terms of their organization, as they involve:

1) students' research of bacterial morphology and structure, serological reactions, experiments on cell cultures, animals and chicken embryos, or on the basis of experiments recorded in videos, movies, presented in computer programs and other educational technologies;

2) solving situational problems (laboratory diagnostics of infectious diseases, assessment of immunity indicators, sanitary and microbiological assessment of the environment, etc.) that have an experimental, clinical, diagnostic or sanitary and hygienic focus.

During practical classes, students are encouraged to briefly record research protocols in their workbooks, indicating the name of the method, the course of work, research results, and conclusions.

The current learning activities of students are monitored at practical

classes in accordance with specific goals. It is recommended to use the following means of diagnosing the level of students' training: testing, written or oral answers to control questions, solving situational problems, conducting laboratory tests and interpreting and evaluating their results, controlling practical skills.

The final control of mastering the discipline is carried out at the end of the exam. The assessment of student performance in the discipline is a rating and is set on a multi-point scale as an arithmetic mean and is defined according to the ECTS system and the scale adopted in Ukraine

Structure of the discipline	Number of hours, including				Year of study semester	Type of control
	Total	Audit		SEW		
		Lectures (hours)	Practical classes (hours)			
<b>Name of the discipline</b> Microbiology, virology, Immunology, including oral microbiology" <b>There are 2 content modules</b>	<b>5 credits/ 150 hours</b>	<b>16</b>	<b>59</b>	<b>75</b>	<b>2nd year (2 semesters)</b>	<b>Test, exam</b>
<b>By semester</b>						
<b>Content module 1</b>	<b>2 credits/ 60 hours.</b>	<b>8</b>	<b>26</b>	<b>26</b>	<b>3 semester</b>	<b>offset</b>
<b>Content module 2</b>	<b>3 credits/ 90 hours.</b>	<b>8</b>	<b>33</b>	<b>49</b>	<b>4 semester</b>	<b>examination</b>

Notes: 1 credit of ECTS - 30 hours. Audit load - 50%, SRS - 50%.

**The subject of study of the discipline** is the normal microflora of the human body and its physiological functions; properties of pathogenic representatives of the world of microbes, their interaction with the human body; mechanisms of development of infectious diseases, methods of their diagnosis, specific prevention and treatment, including diseases of the oral cavity.

**Interdisciplinary links:** the study of "Microbiology, virology, immunology, including oral microbiology" is directly based on the following disciplines: medical biology, medical and biological physics, general biology, botany, biological chemistry, bioorganic chemistry, physiology.

### **1. Purpose and objectives of the discipline**

1.1. The aim of teaching the discipline "Microbiology, Virology, immunology, including oral microbiology" is the study of the properties of normal microflora of the human body, the laws of interaction of microorganism with macroorganism, the immune system and mechanisms of anti-infective immunity, pathogenic to humans microorganisms, diagnostic methods, principles of treatment and specific prevention of infectious diseases, including oral cavity.

The study of microbiology is necessary to understand the role of microorganisms in pathogenesis of dental diseases, the importance of microbiological methods in diagnostics, the knowledge gained

are used in the study of problems of treatment and prevention of dental and related diseases. The applied significance of this discipline is the development of methods of microbiological diagnostics, microbiological bases of asepsis and antiseptics. Taking into account the specifics of the faculty, special attention is paid to the importance of microflora in the development of dental diseases and general pathological processes of stomatogenic and odontogenic origin.

1.2. The main tasks studying educational discipline "Microbiology, virology, immunology, including oral microbiology" are

- Interpret the biological properties of pathogenic and non-pathogenic microorganisms, viruses and patterns of their interaction with the macroorganism, human population and the environment.
- Determine methods of microbiological and virological diagnosis, etiotropic therapy and specific prevention of infectious diseases.
- Explain the structure of the human immune system.

Interpret the main mechanisms of formation of the immune response of the human body.

- Identify the main types of pathological reactions of the immune system and the relationship with the occurrence of the most common human diseases.
- Determine methods of microbiological and virological diagnosis, etiotropic therapy and specific prevention of infectious diseases.

**1.3 Competencies and learning outcomes** contributed to by the discipline (relationship to the normative content of higher education training formulated in terms of learning outcomes in the Higher Education Standard).

According to the requirements of the Standard of Higher Education, the discipline ensures that students acquire **competencies**:

- **General competencies (GC)**

1. Ability to think abstractly, analyze and synthesize.
2. Knowledge and understanding of the subject area and understanding of professional activities.
4. 4. Ability to communicate in the state language both orally and in writing.
6. Skills in the use of information and communication technologies.
7. Ability to search, process and analyze information from various sources.
8. The ability to adapt and act in a new situation.
9. Ability to identify, formulate and solve problems.
10. Ability to be critical and self-critical.
11. Ability to work in a team.
13. Ability to act in a socially responsible and conscious manner.
15. Ability to preserve and enhance moral, cultural, scientific values and achievements of society based on an understanding of the history and patterns of development of the subject area, its place in the general system of knowledge about nature and society and in the development of society, technology and technologies, use different types and forms of physical activity for active recreation and healthy lifestyle.

- **Professional competencies of the specialty (PC)**

1. The ability to collect medical information about a patient and analyze clinical data.
2. Ability to interpret the results of laboratory and instrumental studies.
3. Ability to diagnose: determine preliminary, clinical, final, concomitant diagnosis, emergency conditions.
4. Ability to plan and implement measures for the prevention of diseases of the organs and tissues of the oral cavity and maxillofacial region.
18. Ability to provide first aid according to tactical medicine protocols

- **Program learning outcomes defined by the higher education standard of the specialty:**

2. Collect information about the patient's general condition, assess the patient's psychomotor and physical development, the condition of the maxillofacial organs, and evaluate information about the diagnosis based on the results of laboratory and instrumental studies (according to list 5).
3. Prescribe and analyze additional (mandatory and optional) examination methods (laboratory, radiological, functional and/or instrumental) according to the list 5, patients with diseases organs and tissues of the oral cavity and maxillofacial area for differential diagnosis of diseases (according to list 2)
6. Plan and implement measures to prevent dental diseases among the population to prevent the spread of dental diseases.
8. Determine the approach, plan, type and principle of treatment of a dental disease (according to list 2) by making an informed decision based on existing algorithms and standard schemes.
17. Adhere to a healthy lifestyle, use self-regulation and self-control techniques.

20. To organize the necessary level of individual safety (own and of persons under his/her care) in the event of typical dangerous situations in the individual field of activity.

Detailing competencies in accordance with the NQF descriptors in the form of a "Competency Matrix".

### Competency matrix

№	Competence	Knowledge.	Skills.	Communication	Autonomy and responsibility
1.	Ability to think abstractly, analyze and synthesize.	Mother. specialized conceptual knowledge acquired in the course of study.	Be able to solve complex tasks and problems that arise in professional activities.	Clear and unambiguous communication of own conclusions, knowledge, and explanations that are justified to specialists and non-specialists.	To be responsible for acceptance solutions in difficult conditions
2.	Knowledge and understanding subject area and understanding of professional activities.	Know the peculiarities of professional activity a doctor-dentist...	Be able to carry out professional activities that require updating and integrating knowledge	Develop a communication strategy in professional activities	Be responsible for continuous development with a high level of autonomy
4.	Ability to communicate I speak the state language both orally and in writing	Know the state language, including the professional language....	Be able to use the state language for professional activities and communication	Develop a communication strategy in professional activities	Be responsible for continuous professional development with a high level of autonomy
6.	Skills in the use of information and communication technologies.	Have the necessary knowledge of the use of information and communication technologies	Be able to use information and communication technologies	To use information and communication technologies	To be responsible for the use of information and communication technologies
7.	Search ability, processing and analyzing information from various sources	Have the necessary knowledge in the field of information technology that are used in professional activities.	To be able to use information technologies in the professional field for search, development and analysis of new information from various sources	To use information and technologies in professional activities	Be responsible for the continuous development of professional knowledge and skills.
8.	Ability to adapt and act in a new situation	Know the methods realization of knowledge in solving practical tasks...	Be able to use professional knowledge to adapt and act in a new situation.	Establish connections with subjects of practical activity	To be responsible for the quality of professional tasks in a new situation.
9.	9. Ability to identify, set and resolve	Know the methods and ways to identify and address	Be able to identify, set and resolve	To form a communication strategy in the	Be responsible for quality of execution

	problems	problems...	problems.	professional activity	professional tasks in various situations.
	10.Ability to be critical and self-critical	Know the ways of self-criticism.	Be able to be critical and self-critical	Develop self-criticism	Be responsible for the quality of performance professional tasks
	11.Ability to work in a team.	Know the ways of collective interaction when working in a team...	Be able to use knowledge to choose a strategy communication during the collective interaction	Develop a communication strategy in professional activities	Take responsibility for continuous professional development
	13. Ability to act in a socially responsible and conscious manner.	Know the moral and ethical principles of a medical specialist and rules of professional subordination....	To use in practice moral and ethical principles medical specialist and the rules of professional subordination	To be observed during professional activities moral and ethical principles medical specialist and the rules of professional subordination	Take personal responsibility for compliance moral and ethical principles medical specialist and the rules of professional subordination
	15.Ability to preserve and increase moral, cultural, scientific values and achievements society based on an understanding of the history and patterns of development of the subject area, its place in the general system of knowledge about nature and society and in the development of society, engineering and technology, to use different types and forms of physical activity for active recreation and maintaining a healthy lifestyle.	Have knowledge of modern principles of multiplication moral, cultural, and scientific values of the achievement of society based on an understanding of history and patterns of development subject area	To use the skills of multiplying moral and cultural, scientific values of achievement societies	Be able to identify ways to increase moral and cultural values, scientific values of achievement societies	Take responsibility for effective growth moral, cultural, and scientific values of the achievement of society based on an understanding of history and patterns of development subject area

	Professional competencies				
1.	The ability to collect medical information about a patient and analyze clinical data.	Know how to collect medical information about a patient and analysis clinical data... clinical data.	Be able to collect medical information about the patient and analyze clinical data	Develop a communication strategy for stages of collection and analysis	Carry personal responsibility for the collection and analysis of clinical data
2.	Ability to interpret and deliver results laboratory and instrumental research.	Know how to interpret the results laboratory and of instrumental research.	Be able to interpret the results of laboratory and instrumental research.	Use the information communications for interpretation results laboratory and instrumental research	Be responsible for the interpretation of the results laboratory and instrumental research.
3.	Capacity diagnose: define preliminary, clinical, final, concomitant diagnosis, emergency conditions.	Know the methods diagnostics, definition preliminary, clinical, final, concomitant diagnosis, emergency conditions	Be able to. diagnose: define preliminary, clinical, final, concomitant diagnosis, emergency conditions	The use of you information communication for diagnosis, determination of preliminary and clinical findings, final, concomitant diagnosis, urgent states	... Carry responsibilities for the diagnostics, determination of preliminary, clinical, final, concomitant diagnosis, emergency conditions.
4.	Capacity plan and hold events on prevention diseases organs and tissues oral cavities and maxillofacial area.	Know the ways to planning and holding measures for preventive measures diseases organs and tissues oral cavity.	Be able to plan and conduct activities with preventive measures diseases organs and tissues of the oral cavity and the jaw of the facial area.	To comply plan of action events preventive measures diseases organs and tissues oral cavities and maxillofacial area.	Carry responsibility for planning and holding measures for preventive measures diseases organs and tissues oral cavities and maxillofacial areas
18.	Capacity provide premedical assistance for protocols tactical of medicine.	Know the stages holding treatment main diseases organs and tissues oral cavities and maxillofacial region. In all stages transportation wounded...	Be able to conduct microbiological laboratory diagnostics by means of express methods, treatment basic diseases organs and tissues of the oral cavity and the jaw of the facial area.	Use. additional means during the conduct diagnostics basic diseases organs and tissues oral cavities and maxillofacial areas	Carry responsibility for holding laboratory diagnostics basic diseases organs and tissues oral cavities and maxillofacial areas on all stages according to the protocol.



### Learning outcomes for the discipline

Integrative final programmatic outcomes training, the formation of which the discipline contributes to:

PLO 2. Collect information about the patient's general condition, assess the patient's psychomotor and physical development, the condition of the maxillofacial organs, and evaluate information about the diagnosis based on the results of laboratory and instrumental studies (according to list 5).

PLO 3. Assign and analyze additional (mandatory and optional) examination methods (laboratory, X-ray, functional and/or instrumental) according to List 5, patients with diseases of organs and tissues of the oral cavity and maxillofacial area for differential diagnosis of diseases (according to List 2).

- PLO 6. Plan and implement measures to prevent dental diseases among the population to prevent the spread of dental diseases
- PLO 8. Determine the approach, plan, type and principle of treatment of a dental disease (according to list 2) by making an informed decision using existing algorithms and standard schemes
- PLO 20. To organize the necessary level of individual safety (own and persons under care) in in case of typical dangerous situations in the individual field of activity

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## 2. Information volume of the primary discipline

The discipline is designed to study 5 ECTS credits, 150 hours.

### Content module 1: Morphology and physiology of microorganisms. Genetics of microorganisms. The infection. Immunity. Vaccines and immune serums. Antibiotics.

#### *Introduction to microbiology.*

##### Specific goals:

- Analyze the stages of development of microbiology as a fundamental and applied discipline for medicine and the contribution of individual scientists at each stage.
- Describe the main groups of original methods of microbiological research.
- Interpret the features of the structure, morphology, physiology of certain groups of microbes.

#### Morphology and structure of prokaryotes and parasitic unicellular eukaryotes.

##### Specific goals:

- Choose methods for preparing a bacteriological preparation.
- Draw conclusions from microscopy of bacteriological specimens using an immersion objective.
- Describe the morphological forms of bacteria.
- Explain the structure of a bacterial cell, permanent and non-permanent elements.
- Explain the relationship between the chemical composition, structure, and function of the structural elements of a bacterial cell.
- Interpret the results of microscopic examination of microorganisms.
- Analyze the morphology and structure of spirochetes, actinomycetes, fungi, and protozoa.
- Explain the main differences between pro- and eukaryotes.

#### Physiology of bacteria. Evolution and classification of microorganisms. Genetics of microorganisms.

##### Specific goals:

- Describe the most commonly used culture media and their preparation.
- Explain changes in differential diagnostic media during bacterial growth.
- Draw conclusions about sterilization methods and operating modes of sterilization equipment.
- Evaluate methods for isolating pure cultures of aerobic and anaerobic bacteria.
- Interpret the results of the identification of pure bacterial cultures and draw a conclusion.
- Explain the mechanism of the operon.
- Explain the mechanism of different forms of genotypic variation (mutation and recombination).
- Draw a conclusion about the S- and R-forms of bacterial colonies.
- Know and be able to Explain the mechanism of genetic methods for diagnosing and identifying bacteria.
- Draw a conclusion about whether the microorganism under study belongs to pro- or eukaryotes.

- Explain the relationship between genetic structures and virulence factors of bacteria.

Infection. Specific goals:

- Interpret the concept of "infectious process".
- Analyze the forms of the infectious process, their characteristics and conditions of occurrence.
- Assess the pathogenicity factors of bacteria.
- Characterize the concepts of "pathogenicity" and "virulence".
- Analyze the mechanisms of development of the infectious process (pathogenesis).

The body's immune system. Reactions of nonspecific defense of the body against microorganisms.

Specific goals:

- Analyze the stages of development of immunology and the contribution of individual scientists at each stage.
- Interpret the concept of the body's immune system.
- Explain the role and mechanisms of nonspecific antiinfective defense of the human body.

Antigens. Antibodies. Specific goals:

- Explain the role of antigens as inducers of the immune response.
- Describe the structure of antigens, including antigens of microorganisms.
- Explain the role of antibodies in the immune response.
- Describe the structure of antibodies (different classes of immunoglobulins).
- Analyze the mechanism of interaction of antibodies with antigens.
- Interpret the participation of immune system cells in the immune response and the phases of the immune response.

Immunity reactions. Immunopathology.

Specific goals:

- Analyze the forms and types of immune responses.
- Interpret the phases of immune response development.
- Draw conclusions about the use of microbial antigens in medical practice.
- Draw conclusions about the use of antibodies in medical practice.

Microbiological bases of antimicrobial chemotherapy.

Specific goals:

- Analyze the phenomenon of microbial antagonism.
- Explain the mechanism of action of antibiotics on a microbial cell.
- Evaluate methods for determining the sensitivity of microorganisms to antibiotics.
- Draw conclusions about the sensitivity of microorganisms to antibiotics.
- Interpret the mechanisms of resistance of microorganisms to antibiotics. Explain the mechanisms of complications of antibiotic therapy

Environmental microbiology

Specific objectives:

Interpret the biological properties of pathogenic and opportunistic microorganisms and patterns of their interaction with the human body and the environment.

- Interpret the concept of "sanitary indicator microorganisms" and their role as an indicator in assessing the degree of contamination of environmental objects by pathogenic microorganisms: water, soil and air.
- Analyze the qualitative and quantitative composition of microbes in water, soil, and air and draw conclusions about their epidemiological safety.
- Interpret sanitary, virological, and bacteriological criteria for assessing water bodies, soil, and indoor air.

## **Content module 2. Special, clinical microbiology.**

Pathogenic prokaryotes and eukaryotes.

Specific goals:

- Interpret the biological properties of infectious disease agents.
- Explain the pathogenetic patterns of infectious processes caused by pathogenic

prokaryotes and eukaryotes.

- Determine methods of microbiological diagnosis, etiologic therapy and prevention of infections caused by pathogenic prokaryotes and eukaryotes.

General and special virology

Specific goals:

- Interpret the morphology and ultrastructure of viruses.
- Analyze the interaction of viruses with living systems.
- Evaluate the results of virus reproduction in living systems.
- Analyze methods of virus cultivation in the laboratory.
- Characterize antiviral chemotherapeutic drugs and their mechanism of action.
- Analyze the biological properties of viruses that are pathogenic to humans.
- Explain the role of viruses in human pathology.
- Interpret methods of diagnosing viral infections, draw conclusions based on research results.
- Analyze drugs used for the specific prevention of viral diseases. Fundamentals of clinical microbiology

Specific goals:

- Identify methods of microbiological, virological diagnosis, etiologic therapy and prevention of opportunistic and hospital-acquired infections.

### 3. Structure of the discipline

№ s/ n	TIMETABLE	Lectures	The practic e is busy	SEW	I n d · S W
<i>Introduction to the microbiology</i>					
1	Medical microbiology and its tasks. Methods microbiological research. Trends in the development of modern microbiology.	0,20			
2	Stages of development of medical microbiology.			2	
<i>Morphology and structure of prokaryotes and parasitic unicellular eukaryotes.</i>					
1	Organization and structure of the bacteriological laboratory. Microscopic method of research. Simple methods of staining.		2	2	
2	Morphology and structure of a bacterial cell. Gram staining of bacteria, Ziehl-Nielsen staining.	0,15	2		
3	Morphology and structure of actinomycetes, spirochetes, mycoplasmas and chlamydia.			2	
4.	Morphology and structure of fungi and protozoa.			2	
<i>Physiology of bacteria.</i>					
1	Nutrition, respiration of bacteria. Nutrient media and conditions for cultivating microorganisms.	0,20	1,5		
2	Asepsis and antisepsis. Sterilization of dental material.		0,5	2	
3	Growth and reproduction of microorganisms. Isolation of a pure culture of aerobic bacteria. Cultured properties of bacteria. Genetics of microorganisms.	0,20	2	2	
4	Biochemical properties of bacteria.	0,15	2		
5	Identification of pure bacterial cultures microorganisms. Isolation of pure cultures of anaerobic microorganisms.	0,15	2		
6	Evolution of microorganisms. Systematics, classification and nomenclature of microorganisms.	0,15		2	

<i>Infection.</i>					
1	The infectious process, its forms, conditions of occurrence and development. Factors of pathogenicity of microorganisms. Nonspecific resistance of the organism. Factors. nonspecific protection of the oral cavity	2	2	2	
<i>The body's immune system.</i>					
1	The main stages of immunology development.	0,20		2	
2	Immunity. The organs of the immune system. Cellular and humoral immunity factors.	0,20 0, 20	2	2	
<i>Antigens. Antibodies.</i>					
1	Characterization of antigens.	0.10	0,5	1	
2	Immunoglobulins as a product of humoral immune response.	0.20	0,5	1	
<i>Immunity reactions. Immunopathology.</i>					
1	Immune response reactions. Principles of the use of antigens and antibodies as diagnostic agents. Allergy. Immunopathological processes in the cavity of the mouth.	0,20	3		
2	Immune status of the human body and methods of its assessment.	0,10	1		
<i>Microbiological bases of antimicrobial therapy.</i>					
	Immunoprophylaxis and immunotherapy of infectious diseases Antibiotics and chemotherapeutic agents. The main antimicrobial drugs in dental practice.	2	3	4	
<i>Microbiocenoses of environmental objects</i>					
1	Microbiological control of microbial contamination in dental institutions.		2		
<b>Total for 1 content module 60 hours / 2 credits</b>		<b>8</b>	<b>26</b>	<b>26</b>	

**Content module 2. Special and clinical microbiology.  
General and special virology**

№	Topic.	Number of hours			
		Lectures	Practical training	SRS	in d R S
1	Pathogenic prokaryotes and eukaryotes Staphylococci. Streptococci.	1	2		
2	Neisseria. Gram-negative cocci of the oral cavity.	1	2		
3	The family of intestinal. Enterobacteria are pathogens of the oral cavity.		2	2	
4	Pathogens of particularly dangerous bacterial infections - plague, cholera, anthrax, tularemia, brucellosis.		2	2	
5	Causative agents of respiratory bacterial infections. Corynebacteria. Bordetella. Mycobacteria. Diagnostic media and drugs. Vaccines, medicinal products	2	2		

6	Pathogenic spore anaerobes. Diagnosis. Therapeutic and prophylactic drugs		2		
7	Neclostridial anaerobes - pathogens of dental and oral diseases		1		
8	Pathogenic spirochetes and spirilli. Spirochetes of the oral cavity. The causative agent of rat bite fever. Campylobacter and Helicobacter pylori.		1	3	
9	Rickettsia. Mycoplasmas. Chlamydia.		2	2	
10	Gram-negative non-fermenting and other pathogenic bacteria.			2	
11	Pathogenic actinomycetes and fungi. Their importance in the development of oral diseases cavity.		2		
12	Medical protozoology. The role of protozoa in the development of diseases of the oral cavity.			3	
<i>Clinical microbiology</i>					
1	General characteristics of clinical microbiology. Opportunistic infections.			3	
2	Microecology of the human body. Periodontopathogenic microorganisms.		2		
3	Purulent inflammatory diseases in the dental practice		2		
General and special virology					
1	Morphology and ultrastructure of viruses. Cultivation of viruses.	0.5	2		
2	Serological reactions in virology		2		
3	Mechanisms of immune response in viral infections.			3	
4	Strategy for the treatment and prevention of viral diseases.			3	
5	Orthomyxoviruses	0,5			
6	RNA-containing viruses. Paramyxoviruses			4	
7	General characteristics of picornaviruses		1	3	
8	Viruses causing intestinal infections. Rotaviruses, coronaviruses.			3	
9	Rhabdoviruses. Pathogens of rabies and vesicular stomatitis.			2	
10	Retroviruses. Human immunodeficiency virus	0,5	2		
11	Hepatitis viruses.	0,5	2		
12	Pox-, papoviruses, parvoviruses.	0,15			
13	Herpes viruses	0,5	2		
14	DNA-containing viruses, pathogens of human infectious diseases Adenoviruses	0,15		3	
15	An ecological group of arboviruses.			4	
16	Arena-phyloviruses. Lassa, Marburg, Ebola, Zika viruses			4	
17	Prions. Viroids.			3	
	Total for the content module2	<b>8</b>	<b>33</b>	<b>49</b>	
	<b>Total for content module 2</b> <b>TOTAL hours 150/5 credits</b>	<b>16</b>	<b>59</b>	<b>75</b>	

#### 4. Thematic plan of lectures

No. of s.p.	TOPIC	Number of hours
<b>Content module1. Morphology and physiology of microorganisms. The infection. Immunity. General and special virology.</b>		
1	Medical microbiology, its tasks. Morphology of bacteria. Modern taxonomy of microorganisms. Genetics of microorganisms. Physiology of bacteria.	2
2	Molecular genetic basis of bacterial pathogenicity. The doctrine of infection.	2
3	Immunity. Nonspecific factors of oral resistance. Mechanisms of specific defense. Mechanisms of immune response.	2
4	Strategy of antimicrobial prophylaxis and therapy. Immunoprophylaxis and immunotherapy. Antibiotics and chemotherapy. Characteristics of antimicrobial drugs used in dentistry.	2
	<b>TOTAL</b>	<b>8</b>
<b>Content module 2. Special, clinical and environmental microbiology</b>		
1	Pathogenic festering cocci (staphylococci, streptococci, meningococci, gonococci).	2
2	Diphtheria and tuberculosis pathogens.	2
3	Viruses. Morphology, features of biology. Principles of classification of viruses. Interaction of virus with the cell. Methods of cultivation of viruses. RNA-genomic viruses. General characteristics. Orthomyxoviruses. Retroviruses. Coronaviruses	2
	DNA-genomic viruses. General characteristics. Herpesviruses. Hepatitis (characteristics of pathogens, pathogenesis of diseases, specific diagnosis, treatment and prevention).	
	<b>TOTAL</b>	<b>8</b>

**Total number of hours of lectures in the discipline**

**16**

#### 5 Topic plan of practical classes Content module 1

№ s/n	TIMETABLE	Number of hours
1	Rules of conduct, safety precautions, equipment, and working hours in a microbiology laboratory. The main groups of microorganisms. Microscopic method of research. Basic forms of bacteria. Simple methods of staining.	2
2	Microscopic method of examination. Sophisticated staining methods. Gram's methods, Target. Nielsen. Ultrastructure of a bacterial cell.	2
3.	Physiology of microorganisms. Nutrition, respiration of bacteria. Cultivation of bacteria. Bacteriological method of research. Isolation of pure aerobic culture from carious of the tooth cavity (1 day of the study). Sterilization of dental instruments.	2
4.	Bacteriological method of examination (continued). Isolation of pure aerobic culture from the carious tooth cavity (day 2 of the study).	2
5	Bacteriological method of examination (continued). Isolation of pure aerobic culture from the carious tooth cavity (day 3 of the study).	2
6	Bacteriological method of examination (continued). Isolation of pure aerobic culture from the carious tooth cavity (day 4 of the study). Identification of pure cultures bacteria. Methods of cultivation and isolation of pure cultures of anaerobic bacteria.	2
7	Experimental method of studying infectious diseases. Factors of pathogenicity microorganisms and their role in the development of dental diseases. Nonspecific resistance of the body. Factors of nonspecific protection of the oral cavity.	2
8.	The immune system of the human body. Cellular and humoral factors. Immunoglobulins of the oral cavity.	2

9.	Principles of sero-identification of microorganisms and serodiagnosis of infectious diseases - agglutination reaction (AR), precipitation reaction (PR), complement fixing test (CFT).	2
10.	Modern methods of rapid diagnostics of infectious diseases-reaction Immunofluorescence (IF), enzyme-linked immunosorbent assay (ELISA), polymerasechain reaction (PCR). Allergy. Methods of allergy diagnostics.	2
11	Assessment of immune status of the body of the human body. Immunologycavities of the mouth. Immunoprophylaxis and immunotherapy of infectious diseases.	2
12.	Antibiotics and chemotherapeutic drugs, antiseptics and disinfectants. Requirements for antimicrobials in dental practice.	2
13.	Microbiocenoses of environmental objects. Microbiological control of microbial contamination in dental institutions.	2
	<b>TOTAL</b>	<b>26</b>

### Content module 2

1.	Staphylococci and streptococci, Oral diseases and odontogenic processes caused by gram-positive cocci.	2
2.	Neisseria and other gram-negative cocci. Diseases of the oral cavity caused by Moraxella, Acinetobacter, and Veilonella).	2
3	General characteristics of representatives of the Enterobacteriaceae family. Diagnostic methods, specific prevention and treatment of intestinal infections. The importance of enterobacteria in the development of pathological processes in the oral cavity.	2
4	The causative agents of particularly dangerous bacterial infections are plague, cholera, and anthrax.	2
5.	Causative agents of respiratory bacterial infections. Corynebacteria. Bordetella. Mycobacteria. Diagnostic media and drugs. Vaccines, medicinal products	2
6	Pathogenic spore anaerobes. Diagnostics. Therapeutic and prophylactic drugs. Neclostridial anaerobes - pathogens of dental and oral diseases	2
7.	Pathogenic spirochetes - treponema, borrelia, leptospira. Oral spirochetes. Mycoplasmas. Chlamydia.	2
8.	Pathogenic actinomycetes and fungi. Actinomycosis and mycoses of the oral cavity. Microbiological diagnostics, drugs for treatment.	2
9.	Microecology of the human body. Microbiocenosis of the oral cavity. Stomatitis, caries, pulpitis. Periodontopathogenic microorganisms. Microbiological studies in dentistry.	2
10.	Purulent and inflammatory diseases in dental practice (abscesses, phlegmon, thrombophlebitis, osteomyelitis). Septic conditions, microbiological diagnostics and prevention.	2
11.	General properties of viruses. Methods of cultivation. Features of virus biology	2
12,	Methods of virological diagnostics. Isolation and identification of viruses. Serological diagnostics of viral infections. Express diagnostic methods. Features of the pathogenesis of viral infections. Prophylactic and therapeutic antiviral drugs	2
13.	Retroviruses. Human immunodeficiency virus, properties, pathogenesis of HIV infection and AIDS, virological diagnostics. Prevention and treatment.	2
14..	Hepatitis viruses. Virological diagnosis of hepatitis. Prevention of hepatitis during dental procedures.	2
15.	Herpes viruses. Herpetic lesions of the oral cavity. Virological diagnosis of herpes. Antiherpetic drugs.	2
16.	Oral lesions with aphthoviruses and enteroviruses	2
	<b>TOTAL</b>	<b>33</b>

**Total number of hours of practical classes in the discipline**

**59**

### 5. Thematic plan of students' independent work

Independent study of topics that are not included in the classroom plan:

#### 1 Content module

№	Topic.	Number of hours	Types control
1.	History and stages of development of medical microbiology.	4	EXAM
2.	Types of microscopes, modern methods of microscopic examination of microorganisms.	2	
3.	Morphology and structure of actinomycetes, spirochetes, mycoplasmas and chlamydia.	2	
4.	Morphology and structure of fungi and protozoa	2	
5.	Modern methods of sterilization and disinfection of dental instruments.	2	
6.	Origin and evolution of microorganisms. Modern classification of the world of microbes.	2	
7.	Genetics of microorganisms. Types of variability. Features of the transmission of genetic material from bacteria.	2	
8.	Mechanisms of development of microbial resistance to antibiotics.	2	
9.	The main stages of immunology development. Contribution of P. Ehrlich, I. Mechnikov, E. Ru, Bering's contribution to the development of immunology.	2	
10.	Organs of the immune system.	2	
11.	Modern immunobiological drugs.	2	
12.	The nature and structure of antigens and antibodies.	2	
	<b>TOTAL</b>	<b>26</b>	

2 content module

№.	TOPIC	Number of hours	Type of control
1	Pathogens of tularemia and brucellosis.	2	examination
2	Rickettsia, biological properties. Classification. Rickettsia are pathogens of human diseases.	2	
3	Pathogenic spirillum. Campylobacter and Helicobacter pylori are gastroduodenal pathogens human diseases. The causative agent of rat bite fever. Microbiological diagnosis of the disease	3	
4	Clinical microbiology. Subject, objectives, methods. General characteristics of pathogens of hospital infections.	3	
5	Conditionally pathogenic enterobacteria, Enterobacter, Serratia, Escherichia, Erwinia, Proteus, Klebsiella Providencia.	2	
6	Non-fermenting gram-negative bacilli causing opportunistic infections (Burkholderia, Stenotrophomonas, Chryseobacterium. Pseudomonas aeruginosa, Acinetobacter.	2	
7	RNA-containing viruses are the causative agents of respiratory infections. Paramyxoviruses. Respiratory synthesis virus, parainfluenza, mumps, measles viruses.	4	
8	The mechanism of immune response in viral infections.	3	
9	Strategy for the treatment and prevention of viral infections.	3	
10	General characteristics of the picornavirus family.	3	
11	Viruses causing intestinal infections. Rotaviruses. Coronaviruses.	3	
12	Pathogens of arbovirus infections. Flaviviruses. Tick-borne encephalitis virus. Bunyaviruses. Crimean-Congo hemorrhagic fever virus. Tropical viruses fever.	4	
13	Arena and filoviruses. Lassa, Ebola, Marburg, Zika viruses.	4	
14	DnA-containing viruses are the causative agents of human infectious diseases. Adenoviruses.	3	
15	Rhabdoviruses. Pathogens of rabies and vesicular stomatitis.	2	
16	Characterization of viroids and prions.	3	
17	Pathogens of protozoan diseases. Protozoa of the oral cavity.	3	
	<b>TOTAL</b>	<b>49</b>	

**Total number of hours of independent work in the discipline**

**75**



**6. Individual tasks.** Individual assignments are performed in the form of writing a research paper by students on the topic of the discipline being studied within each content module.

1. Writing essays on topics:

"Composition of normal oral microflora";

"The role of microorganisms in the pathology of the oral cavity".

"The role of viruses in oral pathology";

"Fungi and protozoa are pathogens of the oral cavity."

**7. Teaching methods:** traditional teaching methods: verbal; visual; practical.

Methods of educational and cognitive activity: explanatory and illustrative method, reproductive method, problematic presentation method, partially search or heuristic method, research method.

Methods of stimulation and motivation of educational and cognitive activity: inductive and deductive methods of teaching, methods of stimulation and motivation of learning.

Control methods as teaching methods (teacher control, self-control, mutual control, self-correction, mutual correction).

The relevance of the subject matter of the lesson, the connection with related disciplines, practical skills, ongoing monitoring of students' preparation for the lesson using test tasks of the Krok-1 licensing exam, and the use of interactive methods: "Brainstorming",

"Competitive Group Method, Case Study Method, and other teaching technologies used to transfer and master knowledge, skills, and abilities.

**8. Methods of control.** The section should contain a description of the content and technology of knowledge assessment students, namely, a list of all types of work that a student is required to perform during the current, final control, independent work, individual tasks, and the criteria for their evaluation.

**9. Current control** is carried out in the course of studying a specific topic to determine the level of development of a particular skill or ability, the quality of mastering a certain portion of the educational material by observing students' learning and cognitive activities in class, oral questioning, written control of knowledge and skills through written work (written answers to questions, essays, solving situational problems, etc.) and test control using a set of standardized tasks.

**The current control** is carried out during the training sessions and is aimed at checking the students' mastery of the educational material (it is necessary to describe the forms of current control during the training sessions on a 4-point (national) scale). Forms of assessment of current learning activities should be standardized and include control of theoretical and practical training.

*Assessment of current learning activities.* When assessing the mastery of each topic for the current learning activity, the student is assigned a 4-point (national) grade. This takes into account all types of work provided by the discipline program. The student must receive a grade for each topic for further conversion of grades into points on a multi-point (200-point) scale.

**10. Form of final control of learning progress** (choose: test, exam)

**A semester test is a** form of final control that assesses the student's mastery of the course material solely on the basis of the results of certain types of work performed in practical, seminar or laboratory classes. A semester test in a discipline is conducted after the end of its study, before the start of the examination session.

**The semester exam is a** form of final control of the student's mastery of theoretical and practical material in the discipline.

**11. The scheme of calculation and distribution of points received by students:**

*For disciplines, the form of final control is a test:*

**The maximum number of points** that a student can score for the current learning activity in the discipline is 200 points.

**The minimum number of points** that a student must score for the current academic activity to be enrolled in the discipline is 120 points.

**The number of points is calculated** on the basis of the grades received by the student on a 4-point (national) scale during the study of the discipline, by calculating the arithmetic mean (AM), rounded to two decimal places. The resulting value is converted to points on a multi-point scale as follows:

$$x = \frac{CA \times 200}{5}$$

For your convenience, we have provided a conversion table based on a 200-point scale:

**Recalculating the average grade for current activities into a multi-point scale for disciplines that end in a test**

<b>4-point scale</b>	<b>200-point scale</b>	<b>4-point scale</b>	<b>200-point scale</b>	<b>4-point scale</b>	<b>200-point scale</b>	<b>4-point scale</b>	<b>200-point scale</b>
5	200	4.45	178	3.92	157	3.37	135
4.97	199	4.42	177	3.89	156	3.35	134
4.95	198	4.4	176	3.87	155	3.32	133
4.92	197	4.37	175	3.84	154	3.3	132
4.9	196	4.35	174	3.82	153	3.27	131
4.87	195	4.32	173	3.79	152	3.25 3.22	130
4.85	194	4.3	172	3.77	151	3.2	129
4.82	193	4.27	171	3.74	150	3.17	128
4.8	192	4.24	170	3.72	149	3.15	127
4.77	191	4.22	169	3.7	148	3.12	126
4.75	190	4.19	168	3.67	147	3.1	125
4.72	189	4.17	167	3.65	146	3.07	124
4.7	188	4.14	166	3.62	145	3.02	123
4.67	187	4.12	165	3.57	143	3	121
4.65	186	4.09	164	3.55	142	Less than 3	120
4.62	185	4.07	163	3.52	141		Not enough
4.6	184	4.04	162	3.5	140		
4.57	183	4.02 3.99	161	3.47	139		
4.52	181	3.97	160	3.45	138		
4.5	180	3.94	159	3.42	137		
4.47	179		158	3.4	136		

12. For disciplines, the form of final control is an exam:

**The maximum number of points** that a student can score for current learning activities to be admitted to the exam (differentiated test) is 120 points.

**The minimum number of points** that a student must score for the current learning activity to be admitted to the exam (differentiated test) is 72 points.

**The number of points is calculated** on the basis of the grades received by the student on a 4-point (national) scale during the study of the discipline, by calculating the arithmetic mean (AM), rounded to two decimal places. The resulting value is converted to points on a multi-point scale as follows:

$$x = \frac{CA \times 120}{5}$$

For your convenience, we have provided a conversion table based on a 200-point scale:

**Conversion of the average grade for current activities into a multi-point scale for disciplines that end with an exam**

4-point scale	200-point scale
5	120
4.95	119
4.91	118
4.87	117
4.83	116
4.79	115
4.75	114
4.7	113
4.66	112
4.62	111
4.58	110
4.54	109
4.5	108
4-point scale	200-point scale
4.45	107
4.41	106
4.37	105
4.33	104
4.29	103
4.25	102
4.2	101
4.16	100
4.12	99
4.08	98
4.04	97
3.99	96
3.95	95
4-point scale	200-point scale
3.91	94
3.87	93

3.83	92
3.79	91
3.74	90
3.7	89
3.66	88
3.62	87
3.58	86
3.54	85
3.49	84
3.45	83
3.41	82
4-point scale	200-point scale
3.37	81
3.33	80
3.29	79
3.25	78
3.2	77
3.16	76
3.12	75
3.08	74
3.04	73
3	72
Less than 3	Not enough

Students' independent work is evaluated during the current control of the topic in the relevant class. Mastery of topics that are assigned only for independent work is monitored during the final control.

**The maximum number of points** that a student can score in the exam is 80.

**The minimum number of points to pass the exam** is at least 50.

**The grade in a discipline that ends with an exam** is determined as the sum of points for current learning activities (at least 72) and points for the exam (at least 50).

Points in the discipline are independently converted into both the ECTS scale and the 4-point (national) scale.

ECTS points are not converted to 4-point scale and vice versa.

The scores of students studying in the same specialty, taking into account the number of points gained in the discipline, are ranked on the ECTS scale as follows:

ECTS evaluation	Statistical indicator
A	Top 10% of students
B	The next 25% of students
C	The next 30% of students
D	The next 25% of students
E	The last 10% of students

Ranking with the assignment of grades "A", "B", "C", "D", "E" is carried out for students of this course who are studying in the same specialty and have successfully completed the discipline. Students who have received FX, F ("2") grades are not included in the list of students to be ranked. Students with FX grades automatically receive an "E" grade after retakes.

For students who have successfully completed the program, the discipline points are converted into a traditional 4-point scale according to the absolute criteria shown in the table below:

Points in the discipline	Rating on a 4-point scale
From 170 to 200 points	5
From 140 to 169 points	4
From 139 points to the minimum number of points a student must score	3
Below the minimum number of points a student must score	2

The ECTS grade is not converted to the traditional scale, as the ECTS scale and the four-point scale are independent.

The objectivity of the assessment of students' learning activities is checked by statistical methods (correlation coefficient between ECTS grade and national scale grade).

**13. Methodological support** (educational content (synopsis or extended lecture plan), plans of practical (seminar) classes; tasks for laboratory work, independent work of students; questions or cases for current and final control of knowledge, skills of students, comprehensive control work.

#### **List of questions to be submitted for the final control (exam)**

1. Definition of microbiology as a science. Branches of microbiology. Subject and tasks of medical microbiology. The main features and trends in the development of modern microbiology.
2. The discovery of microorganisms A. Levenguk. Stages of development of microbiology. Contribution of L. Pasteur and R. Koch to microbiology.
3. The main features and trends in the development of modern microbiology. Formation of the main directions of microbiological science. The role of D. Samoilovich, E. Jenner. I. I. Mechnikov, D. Y. Ivanovsky, P. Ehrlich, S. M. Vinogradsky, E. Behring, G. Dogmagk, O. Fleming, D. K. Zabolotny, L. O. Zilber, V. M. Zhdanov. M. P. Chumakov, F. Beret and other scientists' Development of Microbiology in Ukraine.
4. The main differences between prokaryotic and eukaryotic microorganisms. Forms of bacteria with a defect in cell wall synthesis (protoplasts, spheroplasts, L-forms of bacteria).
5. Morphology of bacteria. The role of individual structures in the life of bacteria and in the pathogenesis of infectious diseases.

6. Classification and morphology of protozoa.
7. Classification and morphology of fungi.
8. Microscopy methods.
9. Production of bacteriological preparations. Dyes and auxiliary reagents. Simple and complex staining methods.
10. Bacterioscopic method of examination. Stages.
11. Types and mechanisms of microbial nutrition. Mechanisms of penetration of nutrients into the bacterial cell. Chemical composition of microorganisms, the importance of constituent components.
12. Nutrient media, requirements for them. Classification of nutrient media used in microbiology.
13. Respiration of microorganisms. Aerobic and anaerobic types of respiration. Enzymes involved in the process of respiration; cell structures where respiratory enzymes are localized. Methods of cultivation of anaerobic bacteria.
14. Enzymes of microorganisms, their role in metabolism. Use for identification and differentiation of bacteria. Enzymes of pathogenicity.
16. Growth and reproduction of bacteria. Mechanism of cell division, phases of reproduction of bacterial culture in stationary conditions.
16. Bacteriological method of research. Principles, methods and stages of isolation of pure bacterial cultures and their identification.
17. Influence of physical, chemical and biological factors on microorganisms/ 18. Sterilization, methods and means of sterilization. Control of sterilization efficiency. A1
19. Asepsis. Antiseptic.
20. Methods of sterilization of dental instruments.
21. Origin and evolution of microorganisms. Modern classification of prokaryotes. The main taxa.
22. Systematics and nomenclature of bacteria. Basic principles of systematics. Classification of bacteria. Characterization of the species.
23. The material basis of microbial heredity. Genotype and phenotype. Types of variability. Nonheritable variability.
24. Hereditary variability. Mutations, their types. Physical, chemical, biological mutagens. Genetic recombination: transformation. Transduction, conjugation. Extrachromosomal factors of bacterial heredity. Plasmids/their basic genetic functions. Migratory elements. The role of mutations, recombinations in the selection and evolution of microbes. The main factors of evolution.
25. The importance of genetics in the development of general and medical microbiology, virology, and molecular biology. Microbiological bases of genetic engineering. Obtaining hereditarily altered organisms. Achievements of genetic engineering, the use of genetically engineered drugs in medicine.
26. Chemotherapy and chemotherapeutic drugs. Chemotherapeutic index. Mechanism of antibacterial action of sulfonamides. The role of P. Ehrlich and G. Dogmagk in the development of the doctrine of chemotherapy.
27. Chemotherapeutic antimicrobial drugs used in dental practice.
28. The phenomenon of microbial antagonism. The role of domestic microbiologists in the development of the doctrine of microbial antagonism.
29. Antibiotics, characteristics, principles of preparation, units of measurement. Classification by the mechanism of action on microorganisms.
30. Drug resistance of microbes, the mechanism of formation of resistant forms. Methods for determining the sensitivity of microbes to antibiotics. Minimum inhibitory (MIC) and minimum bactericidal (MBC) concentrations. Practical significance. Principles of combating drug resistance of microorganisms.
31. Infection. Factors causing the occurrence of the infectious process. The role of microorganisms in the infectious process.
32. Pathogenicity, virulence, units of measurement, methods of determination. Factors of pathogenicity of microorganisms, their characteristics.
33. Microbial toxins (exo- and endotoxins). Classification of protein toxins by functional properties. Properties and chemical composition, preparation,

- Measurement of the strength of exotoxins. Role in the pathogenesis and immunogenesis of infectious diseases.
34. Phases of development of the infectious process. Mechanisms of infection with pathogenic microorganisms. Ways of spreading microbes in the human body Bacteremia, toxemia, sepsis. Periods of infectious disease.
  35. The role of the macroorganism in the infectious process. The influence of the environment and social conditions on the occurrence and development of the infectious process in humans.  
Persistence of bacteria and viruses. Forms and types of infection (reinfection, superinfection, mix-infection; the concept of relapse).
  36. The doctrine of immunity. Stages of development of immunology. Types and forms of this manifestation.
  37. Normal microflora of the human body, its role in physiological processes and the occurrence of human pathology. Age-related features of the normal microflora of the nose, skin, mouth, genitals, intestines. Gnotobiology. Dysbiosis and causes of its occurrence.
  38. Probiotics, prebiotics - drugs for restoring normal microflora of the human body (bifidobacterin, lactobacillus, colibacillus, bificol, aerococcobacterin, biosporin, bactisubtil, multibiotics of the Sembiter group, etc.) Mechanism of action.
  39. Normal oral microflora and its role in the human body. Changes in microflora depending on age, health status, tooth loss, etc.
  40. Drugs for biocorrection of dysbiotic changes in the oral cavity.
  41. Nonspecific factors of the body's defense against pathogenic microbes. Complement, its properties, ways of activation. Phagocytosis, types of phagocytic cells. Stages of phagocytosis. Completed and incomplete phagocytosis.
  42. Nonspecific factors of oral cavity protection.
  43. The body's immune system and its organs. The role of the thymus gland in the immune response. Cells of the immune system, their types (T-, B-lymphocytes and macrophages). their role in cellular and humoral immunity.
  44. Forms of the body's immune response. Immunological tolerance, causes of its occurrence. Immunological memory, its mechanism.
  45. Cooperation of cells in the immune response. The role of individual cells of the immune system, their interaction. Cytokines, lymphokines, interleukins.
  46. Major histocompatibility complex. Transplantation immunity.
  47. Antigens. their characteristics. Complete and incomplete antigens. Antigenic structure of bacteria. Practical significance of the doctrine of microbial antigens. Autoantigens.
  48. Antibodies, their chemical nature and structure. Antibody-producing cells, dynamics of antibody production. Autoantibodies.
  49. Classes of immunoglobulins, their characteristics. Immunoglobulins of the oral cavity.
  50. Monoclonal antibodies, their preparation and use in medical practice.
  51. Interaction of antigens and antibodies. Serological reactions, their phenomena. Practical application.
  52. Agglutination reaction, its mechanism, types.
  53. Precipitation technique, its mechanism. Use in medical practice. Precipitation reaction in the gel.
  54. Lysis reactions. Complement binding reaction, its practical use. 55. Reactions with labeled antibodies or antigens. Principles and use of immunofluorescence reactions (IFR), enzyme-linked immunosorbent assay and radioimmunosorbent assay.
  56. Hypersensitivity reactions. their types, mechanism of development. The concept of sensitization and desensitization. Allergic manifestations in the oral cavity.
  57. Immunodeficiency conditions. Primary and secondary immunodeficiencies. Autoimmune diseases.
  58. Comprehensive assessment of the body's immune status. Diagnosis of immunopathological conditions
  59. Vaccines. History of obtaining. Classification of vaccines. Corpuscular, chemical, synthetic, genetically engineered and idiotic vaccines.
  60. Live vaccines, principles of production. Control, practical use of live vaccines, evaluation efficiency.
  61. Chemical vaccines and anatoxins, principles of preparation. Associated vaccines. Adsorbed vaccines, the principle of "depot". Anatoxins, their preparation, purification, units of measurement, use, evaluation. Corpuscular vaccines from killed microbes. Principles of preparation, their control, evaluation of effectiveness.
  62. Immune serums. Purpose, composition, principle of preparation, use.

*Pathogenic prokaryotes and eukaryotes*

63. Evolution of cocci, their general characteristics. Staphylococci, biological properties, classification, practical significance.
64. Role of staphylococci in the development of human pathology, pathogenesis of the processes caused by them. Characterization of toxins and enzymes of pathogenicity. Role in the occurrence of hospital-acquired infection. Methods of microbiological diagnosis of staphylococcal processes and their evaluation. Immunity in staphylococcal diseases. Drugs for specific prophylaxis and therapy, evaluation.
65. Streptococci, biological properties, classification. Toxins, pathogenicity enzymes.
66. Streptococci. The role of development pathology in human pathology. Pathogenesis of streptococcal diseases. Toxins i enzymes of pathogenicity of streptococci. Immunity. Methods of microbiological diagnosis of streptococcal diseases
67. Oral streptococci. Cariogenic streptococci. Biological properties, mechanism of caries development
68. Streptococci of pneumonia, biological properties. Pathogenicity for humans and animals. Microbiological diagnosis of pneumococcal diseases.
69. Meningococci, biological properties, classification. Pathogenesis and microbiological diagnosis of meningococcal diseases and bacterial carriage. Differentiation of meningococci from gram-negative diplococci of the nasopharynx.
70. Gonococci. Biological properties, pathogenesis and microbiological diagnosis of diseases. Prevention and specific therapy of gonorrhea and blenorrea.
71. Neisseria of the oral cavity. Role in the development of pathological processes.
72. Enterobacteria, their evolution. Importance in the development of human pathology. Microbiological diagnosis of colenteritis. Escherichia, their properties. Pathogenic serovars of Escherichia coli, their differentiation. Microbiological diagnosis of coli-enteritis.
73. Pathogenetic bases of microbiological diagnostics of typhoid fever and paratyphoid fever A and B. Methods of microbiological diagnostics, their evaluation. Salmonellae are the causative agents of typhoid fever and paratyphoid fever A and B. Biological properties, antigenic structure. Pathogenesis of diseases. Immunity. Specific prophylaxis and therapy.
74. Salmonellae - causative agents of acute gastroenteritis, their properties. Principles of classification Pathogenesis of foodborne toxic infections of Salmonella nature. Microbiological diagnostics.
75. Genus Shigella, biological properties, classification. Pathogenesis of dysentery.
76. Shigellae. Role in human pathology. Pathogenesis of dysentery, the role of toxins and pathogenicity enzymes. Immunity. Methods of microbiological diagnosis of dysentery, their evaluation.
77. Cholera vibrios, biological properties, biovars. Pathogenesis and immunity in cholera Methods of microbiological diagnosis of cholera and their evaluation. Specific prevention and therapy of cholera.
78. Yersinia. Plague pathogen, history of study, biological properties. The role of domestic scientists in the study of plague. Pathogenesis, immunity, methods of microbiological diagnosis and specific prevention of plague. Yersinia - pathogens of pseudotuberculosis and enterocolitis, properties, microbiological diagnosis of yersinia.
79. The causative agent of tularemia, biological properties. Pathogenesis, immunity, methods of microbiological diagnosis and specific prevention of tularemia.
80. Brucella, species, differentiation. Pathogenesis and immunity in brucellosis. Methods of microbiological diagnosis of brucellosis, their evaluation. Drugs for specific prophylaxis and therapy.
81. Klebsiellae, their role in human pathology. Characterization of Klebsiella pneumoniae, pneumonia, rhinoscleroma. Microbiological diagnostics, specific prophylaxis.
82. Bordetellae, their properties. The causative agent of pertussis, morphological, cultural, antigenic properties. Microbiological diagnosis and specific prevention of pertussis.
83. Anthrax bacilli. Biological characteristics, pathogenesis, microbiological diagnosis and specific prevention of anthrax. The role of domestic scientists in obtaining drugs for the specific prevention of anthrax.
84. General comparative characteristics of anaerobic bacteria, their importance in the development of pathological processes. Features of microbiological diagnostics of diseases caused by anaerobes, caused by anaerobes. Anaerobic nonclostridial bacteria of the oral cavity.
85. Clostridium tetanus, properties. Toxin formation. Pathogenesis of tetanus in humans. Microbiological diagnostics, specific prophylaxis and therapy, their theoretical substantiation and evaluation.
86. Clostridium difficile of botulism. Morphological и cultural features, antigenic structure, toxin formation, classification. Pathogenesis, microbiological diagnosis and therapy of botulism.
87. Pathogens of anaerobic wound infection, properties, classification. Pathogenesis and microbiological diagnosis. Methods of specific prophylaxis and therapy of anaerobic wound infection.
88. Corynebacteria, characterization. Evolution of corynebacteria. Biovars of diphtheria bacilli. Toxin formation, genetic determinants of toxicity. Measurement of toxin strength.
89. Stages of development of the doctrine of diphtheria pathogen. Theoretical foundations of specific prevention of diphtheria. Antidiphtheria drugs.

90. Pathogenesis of diphtheria, immunity. Microbiological diagnosis of bacterial carriage. Differentiation of diphtheria pathogen and saprophytic corynebacteria.
91. The causative agent of diphtheria, biological properties. Characterization of exotoxin. Specific prevention and therapy of diphtheria. Detection of antitoxic immunity. Corynebacteria of the oral cavity.
92. Pathogenic mycobacteria, role in the development of human pathology. Tuberculosis pathogens, properties. Types of tuberculosis bacteria. Pathogenesis and microbiological diagnosis of tuberculosis.
93. Microbiological diagnosis of tuberculosis. Immunity in tuberculosis. Specific prevention and therapy of tuberculosis. Leprosy pathogen, biological features.
94. Mycobacterium tuberculosis, properties. Types of tuberculosis bacteria. Tinctorial and culture properties. Differentiation of tuberculosis pathogens. Atypical mycobacteria. Significance in the development of human pathology.
95. The causative agent of syphilis. Morphological, cultural properties. Pathogenesis and immunity. Microbiological diagnosis and specific therapy of syphilis. Syphilis of the oral cavity. Leptospirae, their characteristics, classification. Pathogenesis, immunity and microbiological diagnosis of leptospirosis. Specific prophylaxis and therapy.
97. Borrelia, biological properties. Role in the development of human pathology. Pathogens of epidemic and endemic typhoid fever. Pathogenesis, immunogenesis and microbiological diagnosis of typhoid fever. Specific prophylaxis and therapy of typhoid fever.
98. The causative agent of Lyme disease. Pathogenesis of the disease, microbiological diagnosis, therapy and prevention.
99. Rickettsia, biological properties. Classification. Rickettsia are pathogens of human diseases. The causative agent of Q fever. Pathogenesis of the disease, laboratory diagnosis, specific prevention.
100. Pathogens of typhus, properties. Pathogenesis of the disease, evaluation of methods. Specific prophylaxis, evaluation of drugs. Laboratory diagnostics.
101. Mycoplasmas, classification. Biological properties, methods of cultivation. Role in the development of human pathology. Microbiological diagnosis of mycoplasmosis.
102. Chlamydia, classification, biological properties. Methods of cultivation. Role in the development of human pathology. Microbiological diagnosis of chlamydia.
103. Campylobacter - pathogens acute intestinal diseases. Biological properties, microbiological diagnostics.
104. Helicobacter pylori is a causative agent of human gastroduodenal diseases. Discovery, biological properties, pathogenesis. Methods of microbiological diagnostics. Modern methods of treatment of Helicobacter pylori infection.
105. Modern methods of laboratory diagnosis of infectious diseases.
106. Pathogenic fungi and actinomycetes (pathogens of candidiasis, dermatomycosis, actinomycosis, their characteristics). Principles of microbiological diagnosis of mycosis.
107. Actinomycosis of the oral cavity. Diagnosis and treatment.
108. Malaria plasmodium, their characteristics. Pathogenesis of malaria. Microbiological diagnostics. Specific prophylaxis and therapy.
109. Toxoplasmas, morphology, features of cultivation. Pathogenesis of diseases. Microbiological diagnostics. Specific therapy.
110. Pathogenic protozoa, biological properties. Classification. Role in the development of human pathology.
111. Leishmania, properties, pathogenesis of diseases. Microbiological diagnosis of leishmaniasis.
112. Conditionally pathogenic microorganisms, biological properties, etiological role in the development of opportunistic infections. Characterization of diseases caused by opportunistic pathogens microorganisms.
113. Hospital-acquired infection, conditions of its occurrence. Properties of hospital microbial ecovars. Microbiological diagnosis of purulent-inflammatory, burn and wound infections caused by hospital strains.
114. Clinical microbiology. Object of research. Subject, tasks, methods. Criteria for the etiologic role of opportunistic microbes isolated from the pathological focus.
115. Ecology of microorganisms. Distribution of microbes in nature. The importance of the works of S.M. Vinogradsky.
116. Normal microflora of the human body, its role in physiological processes and the occurrence of human pathology. Age-related features of the normal microflora of the nose, skin, mouth, genitals, intestines. Gnotobiology. Dysbiosis and causes of its occurrence.
117. Probiotics and eubiotics, their characteristics, mechanism of action.
118. The role of microorganisms in the etiology and pathogenesis of diseases of the teeth (pulpitis, periodontitis), periodontium, oral mucosa, hard and soft tissues of the dentition (abscesses, phlegmons, cysts, etc.).
119. Nonspecific factors of oral defense and immunoglobulins. 120. Plaque microflora, its role in the development of dental caries.
121. Lesions of the oral mucosa in various bacterial and viral infections. Fungal stomatitis.
122. Methods of microbiological diagnosis of infectious pathology of the oral cavity.
123. Hospital-acquired infection, conditions of its occurrence. Properties of hospital ecowashes microorganisms. Microbiological diagnosis of purulent-inflammatory, burn and wound infections caused by hospital strains.



124. Clinical microbiology. Object of research. Subject, objectives, methods. Criteria for the etiologic role of opportunistic pathogenic microbes isolated from the pathological focus.
125. Sanitary microbiology, subject, tasks. The importance of sanitary microbiology in the activity of a doctor. Sanitary-indicative microorganisms, requirements for them, their importance for characterizing environmental objects.
126. Principles of sanitary and microbiological studies of environmental objects, their evaluation. Sanitary and bacteriological control over the quality of drinking water. Requirements of the State Standard for drinking water.
127. Microflora of water. Factors of water self-purification. Survival of pathogenic microorganisms in water. The role of water in the transmission of infectious diseases.
128. Water as a habitat and storage medium for microorganisms. Autochthonous and allochthonous microflora of open water bodies. Saprobility. Microorganisms are indicators of the process of water self-purification.
129. Ecology of microorganisms. Microflora of the environment: air, water, soil. Research methods.
130. Sanitary indicator microorganisms used to assess the quality of water, soil, and air.
131. The role of soil in the transmission of infectious diseases. Factors that soil. Methods of sanitary and microbiological study of soil.
132. Air microflora, its characteristics. The role of air in the transmission of infectious diseases.
133. Microbial counts and sanitary indicative microorganisms of indoor air, methods of determination, their evaluation. Evaluation of microbial contamination of dental institutions.
135. Sanitary indicative air microorganisms, methods of their detection. Criteria for assessing the purity of indoor air.
136. Food poisoning of microbial etiology. Classification of food poisoning and pathogens that cause it.
137. Pathogens of foodborne toxicoinfection. Principles of sanitary and bacteriological studies of food products.
138. Sanitary virology, subject, tasks, importance of sanitary virology in the work of a doctor.
139. Features of virus biology.
140. The place of viruses among autonomous genetic systems (viroids, plasmid transposons). Viruses of bacteria (bacteriophages).
141. Structure of the virion. Simple and complex viruses. Structure of bacteriophages
142. Viral proteins. Structural and non-structural proteins. Virion enzymes and virus-induced enzymes
143. Viral nucleic acids. Viral DNA. Viral RNA of plus and minus type
144. Interaction of viruses with cells. Types of interaction. Stages of interaction
145. Methods of virus cultivation.
146. Cultivation of viruses in laboratory animals. Methods of animal infection, virus detection
147. Cultivation of viruses on chicken embryos. Methods of infection and detection of viruses. Viral hemagglutination reaction
148. Cell culture in virology. Types of cell cultures. Cultivation conditions and media for cell culture.
149. Methods of infection of cell culture. Detection of viruses in cell culture. Cytopathogenic effect of viruses, plaque formation.
151. Features of the pathogenesis of viral infections.
152. Features of immunity in viral infections. The importance of cellular immunity. And cypernetic reactions. Interferons as antiviral factors. Medicinal preparations of interferons, methods of preparation.
153. Serological reactions in virology. Delayed hemagglutination reaction, biological neutralization reaction CDV neutralization reaction.
154. The importance of immunoluminescent, radioimmunoassay and enzyme-linked immunosorbent assay methods in virology.
155. Methods of virological diagnosis. Isolation and identification of viruses
156. Serological diagnosis of viral infections. Study of paired sera, methods  
Identification of classes of specific antibodies and their significance.

157. Methods of genodiagnosis of viral infections. Polymerase chain reaction in the diagnosis of viral infections.
158. Prevention of viral infections. The main types of antiviral vaccines.
159. Chemotherapy of viral infections. The main groups of drugs.
160. Bacteriophages, methods detection i titration. Practical application of bacteriophages.
161. Classification of viruses Main families of RNA-containing and DNA-containing viruses
162. Picornaviruses Main families. Enteroviruses. Poliomyelitis virus, epidemiology, pathogenesis. Virological diagnostics, specific prophylaxis. Coxsackie and ECHO viruses. Cardioviruses, rhinoviruses
163. Orthomyxoviruses, influenza viruses, classification, antigenic structure, pandemic strains. Virological diagnostics. Specific prophylaxis, antiviral drugs
164. Paramyxoviruses. Measles virus, mumps virus. Epidemiology, pathogenesis, specific prevention. Parainfluenza viruses. MS virus.
165. Flavoviruses. Tick-borne encephalitis virus. Epidemiology, pathogenesis, virological diagnosis, prevention.
166. Bunyaviruses. Crimean-Congo hemorrhagic fever virus. Viruses of tropical fevers.
167. Arena and filoviruses. Lassa, Ebola, and Marburg viruses.
168. Viruses causing intestinal infections. Rotaviruses.
169. Viruses are the causative agents of respiratory infections. Coronaviruses.
170. Rhabdoviruses, rabies virus. Epidemiology, pathogenesis, virological diagnosis, prevention. Vesicular stomatitis virus.
171. Retroviruses. Human immunodeficiency virus. Structure of the virion. Genome structure, mechanism of reproduction. Epidemiology and pathogenesis. Mechanism of development of immunodeficiency. Opportunistic infections in HIV/AIDS. Methods of diagnosis of HIV infection-AIDS. Drugs for treatment
172. Hepatitis viruses. Hepatitis A, E. Paraenteric hepatitis B, C, D, G, PP. Epidemiology, pathogenesis, virological diagnosis, prevention.
173. Oncogenic viruses. Viral carcinogenesis in dentistry
174. Poxviruses, general characteristics.
175. Herpes viruses, classification, features of pathogenesis, persistence. Epidemiology, pathogenesis, virological diagnosis, antiviral treatment.
176. Herpetic lesions of the oral cavity. Diagnosis, treatment.
177. Adenoviruses. Epidemiology, pathogenesis, virological diagnosis.

#### **A LIST OF PRACTICAL SKILLS AND TASKS FOR THE EXAM.**

##### *Morphology and physiology of microorganisms. Genetics. Antibiotics. Infection. immunity. Vaccines and immune serums.*

1. Perform microscopy of the preparation using an immersion lens, draw a conclusion about the morphological properties of the microorganisms under study.
2. Prepare a bacterial preparation, stain it with Gram stain, perform microscopy using an immersion objective, and conclude on the purity of the culture of microorganisms under study.
3. Describe the culture properties of microbial colonies that have grown on the surface of the MPA. Justify the need to study the colonies.
4. Describe the properties of colonies of microorganisms that have grown on Endo medium. Find colonies that are characteristic of Esherichia coli. Explain what the differential diagnostic medium Endo is used for.
5. Record the results of determining the enzymatic properties of a pure bacterial culture in the Gies color series. Explain the essence of the method.
6. How is a pure bacterial culture isolated? How to identify bacteria?
7. Explain the methods for determining the sensitivity of bacteria to antibiotics. How is the MIC and MBC of an antibiotic determined?
8. What are cell cultures used for? What nutrient media are used for cell culture and their composition? Growth and maintenance media
9. How do you determine the reproduction of viruses in a chicken embryo and in cell culture?

10. How is the titer of complement in the blood serum determined?
11. How to determine the lysozyme titer in saliva?
12. The complement binding reaction, its mechanism, and practical use.
13. Explain the concept of enzyme-linked immunosorbent assay (ELISA). Record the results of an ELISA performed for the purpose of serological diagnosis.
14. How to perform a serologic diagnosis of an infectious disease? What reactions and diagnostic drugs are needed for this?
15. How to perform serological identification of bacteria? What reactions and diagnostic products are needed for this?
16. How to perform serological identification of viruses? What reactions and diagnostic products are needed for this?
17. Explain the essence of specific prevention of infectious diseases. Select 2-3 live vaccines, explain the principles of their manufacture and use.
18. Explain the essence of specific prevention of infectious diseases. Select 2-3 killed vaccines, explain the principles of their manufacture and use.
19. Explain the essence of specific prevention of infectious diseases. Select drugs to create active antitoxic immunity. Explain the principles of their manufacture and use.
20. Explain the essence of specific therapy of infectious diseases. Select drugs for specific therapy. Explain the principles of their manufacture and use.

***Special, clinical microbiology . General and special virology***

1. To carry out bacterioscopic diagnosis of acute gonorrhoea. Perform microscopy of the stained specimen from the patient's material and draw a conclusion.
2. Perform bacterioscopic diagnosis of tuberculosis. Perform microscopy of a specially stained specimen from a patient. Draw a conclusion.
3. Perform bacterioscopic diagnosis of diphtheria. Perform microscopy of the preparation from the patient's material. Draw a conclusion.
4. Perform serologic diagnosis of typhoid fever and paratyphoid fever. Record the indirect hemagglutination reaction (IHR) and draw a conclusion.
5. Perform serologic diagnosis of typhoid fever and paratyphoid fever. Record the Vidal reaction and draw a conclusion.
6. Perform serologic diagnosis of syphilis. Record the Wasserman reaction and draw a conclusion. Explain the essence of virological diagnosis of influenza. To record the hemagglutination reaction (RHA)
7. Set to detect the virus. To draw a conclusion about the presence and titer of the virus.
8. Explain essence virological diagnostics of influenza. To carry out record reactions inhibition of hemagglutination (RGGA), set up for the purpose of serological identification of the isolated virus. Make a conclusion about the type of virus.
9. Perform serologic diagnosis of influenza. Record the hemagglutination inhibition reaction (HIR) performed with paired patient sera. Draw a conclusion.
10. Explain the essence of virological diagnosis of poliomyelitis. Determine the presence of the virus in cell cultures infected with material from a patient by cytopathogenic effect (CPE) and plaque formation phenomenon. Draw a conclusion.
11. Explain the essence of virological diagnosis of polio. Record the viral neutralization reaction (VNR) performed for the purpose of serological identification of the virus isolated from the patient. Draw a conclusion.
12. Explain the essence of the serological diagnosis of AIDS using the method of enzyme-linked immunosorbent assay.
13. Explain how hepatitis A is diagnosed in the laboratory using the enzyme-linked immunosorbent assay.
14. Explain how to perform laboratory diagnosis of hepatitis B using the enzyme-linked immunosorbent assay.
15. Explain the essence of the genetic method of laboratory diagnosis of infectious diseases using the polymerase chain reaction.
16. Explain the essence of serological diagnosis of viral infections and what are the use serological reactions.

17. Explain the essence of bacteriological diagnosis of typhoid fever and paratyphoid fever. Record the enzymatic properties and perform serological identification of the hemoculture isolated from the patient. Draw a conclusion.
18. Explain the essence of bacteriological diagnosis of dysentery. Record the enzymatic properties and perform serological identification of the copro culture isolated from the patient. Draw a conclusion.
19. Perform serologic diagnosis of brucellosis. Record the Wright's reaction. Draw a conclusion.
20. Explain what drugs are used for specific prevention and specific therapy of diphtheria.

#### 14. Recommended Literature

##### Basic:

1. *Microbiology, Virology and Immunology: a textbook for students of dental faculties* / Danyleichenko VV, Klymnyuk SI, Korniyuchuk OP [et al: "Nova Knyha, 2017 - 376 pp. - ISBN 978-966-382-64-5.
2. *Medical Microbiology, Virology and Immunology: a textbook for university students* / Andrianova T.V., Bobyr V.V., Vinograd V.O. [et al: "New Book, 2021 - 951 p. - ISBN 978-966-382-200-6.
3. *Review of Medical Microbiology and Immunology, 12 edition* / Warren E. Levinson / McGraw- HillProf Med.-Tech., 2012. - 688 p.
4. *Jawetz, Melnick, & Adelberg's Medical Microbiology, 26th Edition, 2012, English.* - 880 p. - ISBN-13: 978-0071790314

##### Auxiliary:

1. *Practical microbiology: Textbook* / S.I. Klimnyuk, I.O. Sytnyk, M.S. Ternopil, Ukrmedkniga, [2004]. 440 p. - ISBN 966-673-059-6.
2. *Jawets. Medical microbiology* / Jawets, Melnick, Adelberg. - The McGraw-Hill Companies, Inc, 2011. -919 p. - ISBN 13: 978-0-07-147666-9.

#### 15. Information resources

1. Official website of the President of Ukraine <http://www.president.gov.ua/>
2. Verkhovna Rada of Ukraine <http://www.rada.gov.ua/>
3. Cabinet of Ministers of Ukraine <http://www.kmu.gov.ua/>
4. Ministry of Education and Science of Ukraine <http://www.mon.gov.ua/>
5. Ministry of Ecology and Natural Resources of Ukraine <http://www.menr.gov.ua/>
6. State Emergency Service of Ukraine <http://www.dsns.gov.ua/>
7. National Security and Defense Council of Ukraine <http://www.rnbo.gov.ua/>
8. Permanent Mission of Ukraine to the United Nations <http://ukraineun.org/>
9. North Atlantic Alliance (NATO) <http://www.nato.int/>
10. World Health Organization <http://www.who.int/en/>
11. Microbiology and immunology on-line <http://www.microbiologybook.org/>
12. On-line microbiology note <http://www.microbiologyinfo.com/>
13. Centers for disease control and prevention  
[www.cdc.gov](http://www.cdc.gov).<http://www.nbu.gov.ua/e-journals/AMI/titul.htm>