

**PRIVATE HIGHER EDUCATIONAL INSTITUTION
"INTERNATIONAL ACADEMY OF ECOLOGY AND MEDICINE"
Department of Fundamental Disciplines**

WORKING PROGRAM OF EDUCATIONAL DISCIPLINE

" MICROBIOLOGY, VIROLOGY AND IMMUNOLOGY "

LEVEL OF HIGHER EDUCATION Second (master's) level

DEGREE OF HIGHER EDUCATION Master's degree

BRANCH OF KNOWLEDGE 22 Healthcare

SPECIALTY 222 Medicine

Reviewed and approved
at the meeting of the Academic Council
Protocol No. 1, dated August 01, 2017

Kiev 2017

Working program of educational discipline Microbiology, virology and immunology for the preparation of applicants for higher education of the second (master's) level of higher education in the specialty 222 Medicine.

Introduction

The program of the discipline " Microbiology, virology and immunology " is composed according to the educational-professional program for training specialists of the second (master's) level of specialty 222 Medicine, field of knowledge 22 Health care, the Law of Ukraine "On Higher Education" from 01.07.2014 № 1556-VII (Article 13, item 7), the provision "On the organization of the educational process in the PHEE" International Academy of Ecology and Medicine ", methodological recommendations approved by the Central Methodical Cabinet of Higher Medical Education of the Ministry of Health of Ukraine on curriculum development standards of higher education. The discipline " Microbiology, virology and immunology " belongs to the section of the General preparation of the curriculum for the preparation of higher education applicants of the second educational (master's) level.

Description of the discipline

| The structure of educational discipline | Branch of knowledge, training direction, specialty, education level | Characteristics of educational discipline | |
|-----------------------------------------|---------------------------------------------------------------------|-------------------------------------------|-------|
| | | Full-time education | |
| Credits ECTS – 8,0 | Field of knowledge: 22 Healthcare | | |
| Modules – 3 | Specialty: 222 Medicine | Year of the education: | |
| Submodules – 14 | | 2 nd , 3 rd | |
| | | Semester | |
| | | IVth | Vth |
| The amount of hours -240 | Educational level: master's degree | Lectures | |
| | | 20 h. | 10 h. |
| | | Practical classes | |
| | | 80 h. | 50 h. |
| | | | |
| | | Self-education (individual work) | |
| | | 50 h. | 30 h. |
| | | | |
| | | Type of control: Current and final, exam | |

The subject of study of the discipline "Microbiology, virology and immunology" is the structural basis of human diseases for in-depth study of the fundamentals of medicine and the clinical picture of diseases with the subsequent use of knowledge in the practice of medicine.

Microbiology (from the Greek. Micro - small, bios - life, logos - science) - is the science of very small, invisible for the naked eye living beings called microorganisms or microbes, their taxonomy, morphology and physiology, ecology and relationships with other living organisms.

The subject of study for the discipline is the properties of pathogenic representatives of the world of microbes, their interaction with the human body, the mechanisms of development of infectious diseases, methods of their diagnosis, specific prevention and treatment.

Interdisciplinary links. Discipline "Microbiology, virology and immunology" is based on knowledge of basic natural sciences: medical biology, medical and biological physics, biological and bioorganic chemistry, human anatomy, histology, cytology and embryology, Latin, history of medicine, philosophy, and integrates with these disciplines.

1. PURPOSE AND TASKS OF THE DISCIPLINE.

1.1. The purpose and objectives of the discipline:

the purpose of studying the discipline is: knowledge of the properties of pathogenic representatives of the world of microbes, their interaction with the human body, the mechanisms of development of infectious diseases, methods of their diagnosis, specific prevention and treatment.

1.2. The main tasks of studying the discipline are

- To interpret the biological properties of pathogenic and non-pathogenic microorganisms, viruses and patterns of their interaction with the host, human population and the environment.
- To determine methods of microbiological and virological diagnostics, etiotropic therapy and specific prevention of infectious diseases.
- To explain the structure of the immune system of the human body.
- To interpret the main mechanisms of formation of the immune response of the human body.
- To identify the main types of pathological reactions of the immune system and the relationship with the occurrence of the most common human diseases.

1.3. Competencies and learning outcomes, the formation of which is facilitated by the discipline .

In accordance with the requirements of the standard, the discipline provides students with the acquisition of competence:

- *integral*: - Ability to solve typical and complex specialized tasks and practical problems in professional activities in the field of health care, or in the learning process, which involves microbiological research and / or implementation of an innovation and is characterized by complexity and uncertainty of conditions and requirements.
- *common*: - Ability to apply knowledge in practical situations. Ability to effectuate selfregulation, to have a healthy lifestyle, ability to adapt and act in a new situation. Ability to choose a communication strategy; ability to work in a team; interpersonal interaction. Skills in the use of information and communication technologies. Ability to abstract thinking, analysis and synthesis, the ability to learn and to be trained modernly. Definiteness and persistence in terms of tasks and responsibilities. Ability to act socially responsibly and with public awareness. The desire to preserve the environment. Universal competencies that do not depend on the subject area, but are important for the successful further professional and social activities of the applicant in various fields and for his personal development.
- *special* (professional, subjective): - Ability to evaluate the results of laboratory and instrumental research. Ability to carry out sanitary and hygienic preventive measures. Ability

to plan preventive and anti-epidemic measures for infectious diseases. Ability to analyze of the state, social, economic and medical information. Ability to assess the impact of socio-economic and biological determinants on the health of the individual, family, population. Ability to apply scientifically substantiated psychological methods of effective work with colleagues, medical staff, patients and their relatives, readiness to interact with other people. Awareness of the individual in the culture of other peoples.

Matrix of competencies

| № | Competence | Knowledge | Skills | Communication | Autonomy and responsibility |
|----------|------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| 1. | Ability to apply knowledge in practical situations | To have specialized conceptual knowledge acquired in the learning process. | To be able to solve complex problems and problems that arise in professional activities. | Clear and unambiguous reporting of own conclusions, knowledge and explanations that substantiate them to specialists and non-specialists. | Responsible for making decisions in difficult conditions |
| 2. | Ability to evaluate laboratory and instrumental results research | To have specialized knowledge about the human, his organs and systems, to know the standard methods of laboratory and instrumental research: Serological reactions in infectious diseases; Rapid tests for viral diseases Amplification methods for infectious diseases; Serological reactions in autoimmune diseases; Chemical and bacteriological | To be able to analyze the results of laboratory and instrumental studies and on their basis to evaluate information about the patient's diagnosis | To appoint and to evaluate the results of laboratory and instrumental research reasonably. | To be responsible for making a decision on evaluation of laboratory and instrumental research results |

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|----|----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | studies of biological fluids and secretions). | | | |
| 3. | Ability to plan preventive and anti-epidemic measures for infectious diseases | To know the principles and systems of planning preventive and anti-epidemic measures for infectious diseases in typical conditions and in conditions of epidemic trouble on the basis of the analysis results, data of inspection in the centers of the outbreaks of infectious diseases. To know the preventive and anti-epidemic methods of organizing measures to prevent the spread of infectious diseases. | To be able to plan (make plans) measures to prevent the spread of infectious diseases on the basis of epidemiological analysis, using preventive and anti-epidemic methods | To inform the population, heads of relevant institutions and enterprises about the opportune implementation of preventive and anti-epidemic measures, vaccinations, etc. | To be responsible for the qualitative analysis of indicators of infectious morbidity of the population, timely carrying out of the corresponding preventive and anti-epidemic measures. |
| 4. | Ability to carry out preventive and anti-epidemic measures against infectious diseases | To know the principles of organizing and conducting a system of preventive and anti-epidemic measures for infectious diseases and | To be able to organize preventive and anti-epidemic measures for infectious diseases in health care facilities, among the population | To inform the heads of health care institutions, local authorities about the epidemic situation and the need for timely and highquality preventive and anti-epidemic | To be responsible for the quality and timeliness of early diagnosis of infectious diseases, the organization of effective preventive and anti-epidemic measures to |

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|----|--------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| | | preventing their spread in typical conditions and during the exacerbation of the epidemic situation. To know the methods of detection and early diagnosis of infectious diseases, the organization of primary antiepidemic measures in the center of infectious diseases. | and in the centers of infectious diseases based on the epidemiological analysis by risk groups, risk areas, time and risk factors. | measures of diseases in the health care institution, among the population and in the centers of the outbreaks of infectious diseases. | prevent the spread of infectious diseases. |
| 5. | Ability to process state, social, economic and medical information | To know standard methods, including modern computer information technologies, processing of state, social and medical information | Ability to determine the source of finding the necessary information depending on its type; ability to conduct statistical processing of material and analysis of the received information | To form conclusions on the basis of the analysis and statistical processing of the received information | To be responsible for high-quality and opportune execution of statistical processing and analysis of the received information |
| 6. | Ability to assess the impact of socio-economic and biological determinants on the health of the individual, family, population | To know the socioeconomic and biological determinants that affect public health; types and methods of prevention to | To be able to calculate indicators of public health based on epidemiological and medical-statistical research. | To obtain the necessary information from identified sources concerning the health of the population and its individual groups and formulate conclusions | To be responsible for the validity of preventive measures to prevent the negative impact of socio-economic factors on the health of the |

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| | | prevent the negative impact of socioeconomic factors on the health of the population and its individual groups | To be able to assess the relationship and impact of socioeconomic and biological factors on the health of the individual, family, health population. To be able to plan preventive measures to prevent the negative impact of socioeconomic factors on the health of the population and its individual groups. | regarding the impact of socioeconomic and biological factors on public health | population and its individual groups |
| 7. | Ability to apply intellectual capabilities and knowledge when working with the patient | To know the worldVIEW: function of bioethics in the formation of civil society and historical aspects of the concept of "human rights" | To be able to detect potential threats of the nature of living organisms | To get the necessary medical, social, special information | To make effective decisions, including in extreme conditions, and to be responsible for them |
| 8. | Ability to provide medical, ethical and legal assessment of specific cases from the position of confidentiality and medical secrecy in solving situational problems for patients with HIV. | To know the Law of Ukraine "On counteracting the spread of diseases caused by the human immunodeficiency virus (HIV), legal and social protection of infectious diseases. | To consider the diversity of human and citizen rights | To apply norms and principles of biomedical ethics and deontology | To be responsible for saving of medical confidentiality. |

Learning outcomes:

upon completion of the study of the discipline, students must

know:

In a medical institution, using a standard procedure, using knowledge about the person, his organs and systems, based on the results of laboratory and instrumental studies to assess information about the diagnosis:

- Serological reactions in infectious diseases of inflammatory profile;
- Microbiological study of biological fluids and secretions;
- Bacteriological study of food and water quality.

be able:

- Evaluate the results of laboratory and instrumental research;
- Anticipate the negative effects of dangerous factors on the human body;
- Master the modern methods of microbiological research in infectious diseases;
- Analyze the principles of obtaining vaccines, methods of their standardization and control, practical use;
- Master the principles of production of immune sera, methods of their standardization, control, practical significance;
- Interpret the development of medicine in historical retrospect;
- Interpret the main historical and medical events;
- Demonstrate mastery of moral and ethical principles of attitude to a living person, his body as an object of anatomical and clinical research.

2. CONTENTS OF EDUCATIONAL DISCIPLINE.

240 hours of 8.0 ECTS credits are for the study of the academic discipline, incl. lectures 30 hours, practical 130 hours, independent work 80 hours. Normative discipline.

The program of the discipline is structured into 3 modules:

Module 1. Morphology and physiology of microorganisms. Infection. Immunity. General and special virology.

Content module 1. Introduction to microbiology.

Content module 2. Morphology and structure of prokaryotes and parasitic unicellular eukaryotes. Staining of microorganisms. Microscopy.

Content module 3. Physiology of microorganisms (prokaryotes). Evolution and classification of microorganisms.

Content module 4. Genetics of microorganisms.

Content module 5. Microbiological bases of antimicrobial chemotherapy.

Content module 6. Infection.

Content module 7. The body's immune system. Reactions of nonspecific protection of an organism against microorganisms.

Content module 8. Antigens. Antibodies.

Content module 9. Immunity reactions. Immunopathology.

Module 2. General and special virology.

Content module 10. General virology.

Content module 11. Special virology.

Module 3. Special, clinical and ecological microbiology.

Content module 12. Pathogenic prokaryotes and eukaryotes.

Content module 13. Fundamentals of clinical and environmental microbiology.
Content module 14. Sanitary microbiology and virology.

3. THE STRUCTURE OF EDUCATIONAL DISCIPLINE.

| Names of modules, submodules and topics | Number of hours | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----------------------|--------------------------------------------|
| | Lecturers | Practice – no classes | SRS |
| 1 | 2 | 3 | 4 |
| Module I. Morphology and physiology of microorganisms. The infection and immunity. | | | |
| Organization of bacteriological laboratory. Microscopy. Dyes and simple staining methods of microorganisms. Morphology of bacteria. | 2 | 3 | The distribution shown in the tables below |
| Staining method by Gram. Structure of bacteria, inclusions, capsules, flagellas. Methods of their revealing. Methods of spores and acid resistance bacteria revealing | 2 | 3 | |
| Morphology of Spirochaetes, Actinomycetes, Fungi, Protozoa, Rickettsiae, Chlamydia and Mycoplasma. | - | 3 | |
| Nutrient media for culturing of microorganisms. Sterilization. Growth and reproduction of microorganisms. Bacteria pure cultures isolation. | 2 | 3 | |
| Growth and reproduction of microorganisms. Bacteria pure cultures isolation. (2 less) | - | 3 | |
| Bacteria pure cultures isolation | - | 3 | |
| Chemotherapy drugs. Antibiotics. Infectious process. Types, origin and development conditions. | | 3 | |
| Factors of unspecific protection of macroorganism to microorganisms. | 2 | 3 | |
| Serological tests. Precipitation and neutralization tests. | - | 3 | |
| Serological tests. Agglutination tests. | - | 3 | |
| Serological tests. Reaction of immune lysis. Complement binding test (CBT). Serological tests with the labels. | 2 | 3 | |
| Vaccines and immune serums. Immunopathology. Assessment of immune status of the organism. | - | 3 | |
| Final modul 1 control: practical training theoretical training. | - | 4 | |
| Total | 10 | 40 | 30 |
| Module II. General and special virology. | | | |
| Modern methods of infectious diseases | 2 | 2 | The |

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| diagnosis. | | | distribution shown in the tables below |
| Morphology and ultrastructure of viruses. Cultivating of viruses. Indication of viral reproduction. | 2 | 2 | |
| Bacteriophages, morphology and structure. Methods of qualitative and quantitative determination of bacteriophages. | - | 2 | |
| Serological reactions in virology. | - | 2 | |
| Orthomyxoviruses. Laboratory diagnosis of influenza. | - | 2 | |
| Family Paramyxoviridae - parainfluenza, measles, epidemic parotitis, respiratory syncytial viruses. | - | 2 | |
| Family of Rabdoviruses, properties of viruses. Specific prevention of rabies. | - | 2 | |
| Pikornaviruses. Laboratory diagnosis of enteroviral infections. | - | 2 | |
| Retroviruses. HIV. Laboratory diagnosis of HIV infection. | 2 | 2 | |
| Other RNA genomic viruses (Ruby-, Reoviruses). | - | 2 | |
| Test control by topics 1-10. | - | 2 | |
| Pathogens of viral hepatitis. Laboratory diagnosis of hepatitis A and E. | 1 | 2 | |
| Pathogens of viral hepatitis. Laboratory diagnosis of hepatitis B, C, D. | 1 | 2 | |
| Herpesviruses. Laboratory diagnosis of herpes virus infections. | 1 | 2 | |
| Adenoviruses. Laboratory diagnosis of adenoviral infections. Poxviruses. | 1 | 2 | |
| Ecological group of arboviruses. Flaviviruses, Filoviruses and Bunyaviruses. Laboratory diagnosis of flaviviral, filoviral and bunyaviral infections. | - | 2 | |
| Oncoviruses. | - | 2 | |
| Test control. | - | 2 | |
| Final control of practical skills. | - | 2 | |
| Final module control 2. | - | 2 | |
| Total | 10 | 40 | 30 |
| Module III. Special, clinic al and ecological microbiology. | | | |
| Staphylococci and Streptococci. Microbiological diagnostics of diseases caused by Staphylococci and Streptococci. | 2 | 2 | The distribution shown in the tables below |
| Meningococci. Microbiological diagnostics of meningococcal diseases. Gonococci. Microbiological diagnostics of meningococcal diseases. | | 2 | |
| Escherichia. Microbiological diagnostics of the diseases caused by E.coli. | 2 | 2 | |
| Salmonella. Microbiological diagnostics of typhoid and paratyphoids. | | 2 | |
| Salmonella. Microbiological diagnostics of salmonella gastroenteritis. | 2 | 2 | |

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|------------------------------------------------------------------------------------------------------------------|-----------|------------|-----------|
| Shigella. Microbiological diagnostics of dysentery. | - | 2 | |
| Vibrio. Microbiological diagnostics of cholera. | - | 2 | |
| Corynebacteria. Microbiological diagnostics of diphtheria. | - | 2 | |
| Pathogenic agent of pertussis. Microbiological diagnostics of pertussis. Test control (1-9 topics) | 2 | 2 | |
| Mycobacteria. Microbiological diagnostics of tuberculosis. | 2 | 2 | |
| Pathogenic agents of anaerobic infections. Microbiological diagnostics of anaerobic wounds infection. | - | 2 | |
| Pathogenic agents of anaerobic infections. Microbiological diagnostics of tetanus and botulism. | - | 2 | |
| Pathogenic agents of zoonotic infections. Microbiological diagnostics of anthrax and brucellosis. | - | 2 | |
| Pathogenic agents of zoonotic infections. Microbiological diagnostics of plague and tularemia. | - | 2 | |
| Rickettsia, Chlamydia, Mycoplasma. Microbiological diagnostics of rickettsiosis, chlamydiosis and mycoplasmosis. | - | 2 | |
| Spirochaetes. Microbiological diagnostics of Syphilis. | - | 2 | |
| Spirochaetes. Microbiological diagnostics of recurrent fever and leptospirosis. | - | 2 | |
| Pathogenic fungi. Microbiological diagnostics of mycoses. | - | 2 | |
| Human normal microflora. | - | 2 | |
| Clinical microbiology (1 lesson). | - | 2 | |
| Clinical microbiology (2 lesson). | - | 2 | |
| Hospital infections. | - | 2 | |
| Sanitary microbiology. | - | 2 | |
| Final test control. | - | 2 | |
| Practical skills control. | - | 2 | |
| Total | 10 | 50 | 20 |
| Total for the course | 30 | 130 | 80 |

According to with requirements educational and professional programs students should: know:

- symptoms and course of diseases;
- methods of diagnostic and therapeutic procedures appropriate for specific disease states;

be able:

- communicate and share knowledge with colleagues in a team;
- critically evaluate the results of scientific research and adequately justify the position;
- carry out a physical examination of a child of all ages;
- carry out a medical interview with the child and his or her family;
- plan specialist consultations;

- identify medical problems and prioritize medical management;
- plan the diagnostic procedure and interpret its results;
- implement appropriate and safe therapeutic treatment and predict its effects;
- plan diagnostic, therapeutic and prophylactic procedures;
- interpret the results of laboratory tests and identify the causes of abnormalities;
- identify life-threatening conditions that require immediate medical intervention;
- plan own learning activities and constantly learn in order to update own knowledge;
- maintain patient's medical records;
- communicate with the patient and his family in an atmosphere of trust, taking into account the needs of the patient.

is ready to:

- to establish and maintain deep and respectful contact with patients and to show understanding for differences in world views and cultures
- respect medical confidentiality and patients' rights
- to be guided by the well-being of a patient
- use objective sources of information
- formulate conclusions from own measurements or observations
- take actions towards the patient on the basis of ethical norms and principles, with an awareness of the social determinants and limitations of the disease.

4. THEMATIC PLAN OF LECTURES

The 4th semester

| № | TOPIC | Hours |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| | Module I. Morphology and physiology of microorganisms. The infection and immunity. | |
| 1 | Value of medical microbiology in practical activity of doctor. Original methods of microbiological research. Evolution and classification of microorganisms. Morphology of microorganisms. Microbes have chemical composition and metabolism. Height and reproduction of microorganisms. | 2 |
| 2 | Chemotherapeutic preparations. Antibiotics. Studies are about an infection. | 2 |
| 3 | History of development of immunology. Heterospecific factors of defence. Immune system of organism. Antigens. | 2 |
| 4 | Antibodies, structure. Classes of immunoproteins. Cooperation of cells of the immune system is in an immune answer. | 2 |
| 5 | Immunopathological reactions. Immunoprophylaxis and immunotherapy. | 2 |
| Total: | | 10 |

| № | TOPIC | Hours |
|---|-------------------------------------------------------------------------------------|-------|
| | Module II. General and special virology. | |
| 1 | General virology. Morphology and ultrastructure of viruses. Cultivation of viruses. | 2 |

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|---------------|--------------------------------------------------------------------------------------------------|-----------|
| 2 | RNA genomic viruses. General characteristics. Orthomyxoviruses. Paramyxoviruses. Picornaviruses. | 2 |
| 3 | Retroviruses, general description. Oncoviruses. HIV. | 2 |
| 4 | Viruses of hepatitis. | 2 |
| 5 | DNA genomic viruses. General characteristics. Adeno- and herpesviruses. | 2 |
| Total: | | 10 |

The 5th semester

| № | TOPIC | Hours |
|---------------|--------------------------------------------------------------------|--------------|
| | Module III. Special, clinic al and ecological microbiology. | |
| 1 | Pathogenic cocci. | 2 |
| 2 | Pathogenic enterobacteria. | 2 |
| 3 | Pathogens of diphtheria. | 2 |
| 4 | Pathogens of tuberculosis. | 2 |
| 5 | Pathogens of anaerobic infections. Pathogenic spirochetes. | 2 |
| Total: | | 10 |

5. THEMATIC PLAN OF PRACTICAL CLASSES

The 4th semester

| № | Topic | Hours |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| | Module 1. Morphology and physiology of microorganisms. Infection. Immunity. | |
| 1. | Organization of bacteriological laboratory. Microscopy. Dyes and simple staining methods of microorganisms. Morphology of bacteria. | 3 |
| 2. | Staining method by Gram. Structure of bacteria, inclusions, capsules, flagellas. Methods of their revealing. Methods of spores and acid resistance bacteria revealing | 3 |
| 3. | Morphology of Spirohaetes, Actinomycetes, Fungi, Protozoa, Rickettsiae, Chlamydia and Mycoplasma. | 3 |
| 4. | Nutrient media for culturing of microorganisms. Sterilization. Growth and reproduction of microorganisms. Bacteria pure cultures isolation. | 3 |
| 5. | Growth and reproduction of microorganisms. Bacteria pure cultures isolation. (2 less) | 3 |
| 6. | Bacteria pure cultures isolation | 3 |
| 7. | Chemotherapy drugs. Antibiotics. Infectious process. Types, origin and development conditions. | 3 |
| 8. | Factors of unspecific protection of macroorganism to microorganisms. | 3 |
| 9. | Serological tests. Precipitation and neutralization tests. | 3 |
| 10. | Serological tests. Agglutination tests. | 3 |
| 11. | Serological tests. Reaction of immune lysis. Complement binding test (CBT). Serological tests with the labels. | 3 |

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|-----|-------------------------------------------------------------------------------------------|-----------|
| 12. | Vaccines and immune serums. Immunopathology. Assessment of immune status of the organism. | 3 |
| 13. | Final modul 1 control: practical training theoretical training. | 4 |
| | Total | 40 |

| No | Topic | Hours |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| | Module 2. General and special Virology | |
| 1. | Modern methods of infectious diseases diagnosis. | 2 |
| 2. | Morphology and ultrastructure of viruses. Cultivating of viruses. Indication of viral reproduction. | 2 |
| 3. | Bacteriophages, morphology and structure. Methods of qualitative and quantitative determination of bacteriophages. | 2 |
| 4. | Serological reactions in virology. | 2 |
| 5. | Orthomyxoviruses. Laboratory diagnosis of influenza. | 2 |
| 6. | Family Paramyxoviridae - parainfluenza, measles, epidemic parotitis, respiratory syncytial viruses. | 2 |
| 7. | Family of Rabdoviruses, properties of viruses. Specific prevention of rabies. | 2 |
| 8. | Pikornaviruses. Laboratory diagnosis of enteroviral infections. | 2 |
| 9. | Retroviruses. HIV. Laboratory diagnosis of HIV infection. | 2 |
| 10. | Other RNA genomic viruses (Ruby-, Reoviruses). | 2 |
| 11. | Test control by topics 1-10. | 2 |
| 12. | Pathogens of viral hepatitis. Laboratory diagnosis of hepatitis A and E. | 2 |
| 13. | Pathogens of viral hepatitis. Laboratory diagnosis of hepatitis B, C, D. | 2 |
| 14. | Herpesviruses. Laboratory diagnosis of herpes virus infections. | 2 |
| 15. | Adenoviruses. Laboratory diagnosis of adenoviral infections. Poxviruses. | 2 |
| 16. | Ecological group of arboviruses. Flaviviruses, Filoviruses and Bunyaviruses. Laboratory diagnosis of flaviviral, filoviral and bunyaviral infections. | 2 |
| 17. | Oncoviruses. | 2 |
| 18. | Test control. | 2 |
| 19. | Final control of practical skills. | 2 |
| 20. | Final module control 2. | 2 |
| | Total | 40 |

The 5th semestr

| Nº | Topic | Hours |
|----|----------------------------------------------------------------------------------------------------------------------------------------|-------|
| | Module 3. Special, clinical and ecological microbiology. | |
| 1. | Staphylococci and Streptococci. Microbiological diagnostics of diseases caused by Staphylococci and Streptococci. | 2 |
| 2. | Meningococci. Microbiological diagnostics of meningococcal diseases. Gonococci. Microbiological diagnostics of meningococcal diseases. | 2 |
| 3. | Escherichia. Microbiological diagnostics of the diseases caused by E.coli. | 2 |
| 4. | Salmonella. Microbiological diagnostics of typhoid and paratyphoids. | 2 |

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|-----|------------------------------------------------------------------------------------------------------------------|-----------|
| 5. | Salmonella. Microbiological diagnostics of salmonella gastroenteritis. | 2 |
| 6. | Shigella. Microbiological diagnostics of dysentery. | 2 |
| 7. | Vibrio. Microbiological diagnostics of cholera. | 2 |
| 8. | Corynebacteria. Microbiological diagnostics of diphtheria. | 2 |
| 9. | Pathogenic agent of pertussis. Microbiological diagnostics of pertussis. Test control (1-9 topics) | 2 |
| 10. | Mycobacteria. Microbiological diagnostics of tuberculosis. | 2 |
| 11. | Pathogenic agents of anaerobic infections. Microbiological diagnostics of anaerobic wounds infection. | 2 |
| 12. | Pathogenic agents of anaerobic infections. Microbiological diagnostics of tetanus and botulism. | 2 |
| 13. | Pathogenic agents of zoonotic infections. Microbiological diagnostics of anthrax and brucellosis. | 2 |
| 14. | Pathogenic agents of zoonotic infections. Microbiological diagnostics of plague and tularemia. | 2 |
| 15. | Rickettsia, Chlamydia, Mycoplasma. Microbiological diagnostics of rickettsioses, chlamydiosis and mycoplasmosis. | 2 |
| 16. | Spirochaetes. Microbiological diagnostics of Syphilis. | 2 |
| 17. | Spirochaetes. Microbiological diagnostics of recurrent fever and leptospirosis. | 2 |
| 18. | Pathogenic fungi. Microbiological diagnostics of mycoses. | 2 |
| 19. | Human normal microflora. | 2 |
| 20. | Clinical microbiology (1 lesson). | 2 |
| 21. | Clinical microbiology (2 lesson). | 2 |
| 22. | Hospital infections. | 2 |
| 23. | Sanitary microbiology. | 2 |
| 24. | Final test control. | 2 |
| 25. | Practical skills control. | 2 |
| | Total | 50 |

6. THEMATIC PLAN OF INDEPENDENT WORK OF STUDENTS (IWS)

The 4th semester

| № | MODULE 1 TOPIC | Hours | Type of control |
|-----|---------------------------------------------------------------------------------------------------|-----------|--------------------------------------|
| 1 | Preparation for practical classes - theoretical preparation and working off the practical skills. | 14 | Current control in practical classes |
| 2 | Elaboration of topics that are not included in the lesson plan: | | |
| 2.1 | Dependence of the results of dyeing of microorganisms on their properties. | 2 | Final modular control |
| 2.2 | Test system for determining the enzymatic activity of microorganisms. | 2 | -- |
| 2.3 | The origin and evolution of microorganisms. Basic principles of taxonomy of microorganisms. | 2 | -- |
| 2.4 | Genetics of microorganisms. | 2 | -- |
| 2.5 | Modern test systems for determining the sensitivity of microbes to antibiotics. | 2 | |
| 2.6 | Hypersensitivity of immediate and delayed type, their mechanisms, differences. Practical meaning | 2 | |
| 3. | Preparation for the final modular control | 4 | Final modular control |
| | Total | 30 | |

| № | MODULE 2 TOPIC | Hours | Type of control |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------------------------------------|
| 1. | Preparation for practical classes - theoretical preparation and working off the practical skills. | 18 | Current control in practical classes |
| 2 | Elaboration of topics that are not included in the lesson plan: | | |
| 2.1. | Modern test systems for determining the sensitivity of microbes to antibiotics. | 2 | Final modular control |
| 2.2. | Hypersensitivity of immediate and delayed type, their mechanisms, differences. Practical meaning | 2 | -- |
| 2.3. | History of discovery and the main stages of the development of virology. Contribution of domestic scientists. Methods of studying viruses, their evaluation. | 2 | -- |
| 2.4. | Prospective directions for effective influenza vaccines obtaining. | 2 | -- |
| 3 | Preparation for the final modular control | 4 | Final modular control |
| | Total | 30 | |

The 5th semester

| № | MODULE 3 TOPIC | Hours | Type of control |
|------|----------------------------------------------------------------------------------------------------------|-----------|---------------------------------------------|
| 1. | Preparation for practical classes - theoretical preparation and working off the practical skills. | 13 | Current control in practical classes |
| 2 | Elaboration of topics that are not included in the lesson plan: | | |
| 2.1. | Problems and prospects for obtaining vaccine drugs for the prevention of hepatitis. Modern vaccines. | 2 | Final modular control |
| 2.2. | Prions, properties. Prion diseases | 2 | -“- |
| 3 | Preparation for the final modular control | 3 | Final modular control |
| | Total | 20 | |
| | Total for the course | 80 | |

7. THE LIST OF THEORETICAL QUESTIONS FOR PREPARATION OF STUDENTS TO THE FINAL MODULAR CONTROL.

LIST OF THEORETICAL QUESTIONS FOR THE FINAL MODULE CONTROL №1

1. Definition of microbiology as a science. Branches of microbiology. Subject and tasks of medical microbiology. The main features and trends of modern microbiology.
2. Discovery of microorganisms by A. Levenhuk. Stages of development of microbiology. The contribution of L. Pasteur and R. Koch in microbiology.
3. Formation of the main directions of microbiological science. The role of D. Samoilovich, E. Jenner, II Mechnikov, D. Ivanovsky, P. Ehrlich, SM Vinogradsky, E. Bering, G. Ramon, F. Lesh, G. Domagko, O Fleming, DK Zaboltny, L.O. Zilber, VM Zhdanov, MP Chumakov, F. Burnett and other scientists. Development of microbiology in Ukraine.
4. The main differences between prokaryotes and eukaryotes. Forms of bacteria with a defect in the synthesis of the cell wall, protoplasts, spheroplasts. L-forms of bacteria.
5. **Morphology and structure of bacteria.** The role of certain structures for bacterial activity and in the pathogenesis of infectious diseases. Vegetative forms and spores.
6. Morphology of rickettsiae, chlamydia mycoplasmas. Methods of studying their morphology.
7. Spirochetes (treponema, borrelia, leptospira). Features of morphology and structure, motility. Actinomycetes, features of morphology.
8. **Morphology and classification of protozoa.**
9. Classification and morphology of fungi.
10. Methods of microscopy. Preparation of bacteriological smears. Dyes and dyeing solutions, simple and complex methods of stain.
11. Principles of organization, equipment and mode of operation of bacteriological, serological and virological laboratories.
12. Bacterioscopic method of research. Stages.
13. Complex methods of staining of microorganisms. Gram staining technique. Factors that affect the staining of microorganisms by Gram. The practical significance of the Gram staining.

method.

14. Types and mechanisms of nutrition of microorganisms. Mechanisms of nutrient penetration into the bacterial cell. Chemical composition of microorganisms. The value of the components. Nutrient media, requirements for them. Classification of nutrient media used in microbiology.

15. Nutrient media, requirements for them. Classification of nutrient media used in microbiology.

16. Respiration of microorganisms. Aerobic and anaerobic types of respiration. Enzymes and cell structures involved in the process of respiration. Methods of growing of anaerobic bacteria.

17. Enzymes of microorganisms, their role in metabolism. Use for bacterial differentiation. Pathogenicity enzymes.

18. Growth of bacteria and methods of bacterial reproduction. Mechanism of cell division, phases of reproduction of bacterial culture in stationary conditions.

19. Bacteriological method of research. Principles of isolation of pure cultures of bacteria and their identification.

20. Effect of physical, chemical and biological factors on microorganisms. Sterilization, methods, control over sterilization efficiency. Asepsis. Antisepsis.

21. Extrachromosomal factors of bacterial heredity. Plasmids, their main genetic functions. Migrating elements. Integrations and super-integrations. The role of mutations, recombination and selection in microbial evolution. The main factors of evolution.

22. Chemotherapy and chemotherapeutic drugs. Chemotherapeutic index. The mechanism of antibacterial action of sulfonamides. The role of P. Ehrlich and G. Domagko on the development of the theory of chemotherapy.

23. The phenomenon of microbial antagonism. The role of Ukrainian microbiologists in the development of the doctrine of microbial antagonism. Antibiotics, characteristics, principles of production, units of measurement. Classification by mechanism of action on microorganisms.

24. 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 meaning. Principles of combating drug resistance of microorganisms.

25. Complications of antibiotic therapy. Dysbiosis. Antibiotic-resistant, antibiotic-dependent and antibiotic-tolerant strains of bacteria.

26. Infection. Factors that cause the occurrence of the infectious process. The role of microorganisms in the infectious process. Pathogenicity, virulence, units of measurement, methods of determination. Factors of pathogenicity of microorganisms, their characteristics.

27. Microbial toxins (exo- and endotoxins). Properties and chemical composition, production, measurement of exotoxin strength. Role in the pathogenesis and immunogenesis of infectious diseases.

28. Phases of development of the infectious process. Mechanisms of infection with pathogenic microorganisms. Bacteremia, toxinemia, sepsis. Periods of infectious disease.

29. The role of the macroorganism in the infectious process. Immunological reactivity of the child's body. The influence of the environment and social conditions on the emergence and development of the infectious process in humans. Persistence of bacteria and viruses. The concept of relapse, reinfection, superinfection.

30. The doctrine of immunity. Stages of development of immunology. Types of immunity and forms of its manifestation.

31. Nonspecific factors of protection of an organism against pathogenic microbes. Complement, its properties, activation pathways. Cytokines.

32. Nonspecific factors of protection of an organism against pathogenic microbes. Stages of phagocytosis. Complete and incomplete phagocytosis. The doctrine of Toll-receptors of phagocytes.

33. The body's immune system, its organs. The role of the thymus gland in the immune response. Cells of the immune system, their varieties, the interaction of T-, B-lymphocytes and macrophages. Their role in cellular and humoral immunity.
34. Cells of the immune system, their varieties, the interaction of T-, B-lymphocytes and macrophages. Their role in cellular and humoral immunity.
35. Immune response reactions, their characteristics. Cellular immune response.
36. Patterns of the body's immune response. Phases of the immune response. Immunological reactions. Immunological tolerance, causes of its occurrence. Immunological memory, its mechanism.
37. Immediate and delayed hypersensitivity, their mechanisms, differences. Practical meaning.
38. Tricellular system of immune response cooperation. The role of individual cells of the immune system, their interaction. Interleukins.
39. Antigens, their characteristics. Complete and incomplete antigens. Antigenic structure of bacteria. The practical significance of the doctrine of microbial antigens. Autoantigens.
40. Antibodies, their nature. Place of synthesis, dynamics of antibody production.
41. Plasmocytes: the concept of "plasma cell clone". Autoantibodies.
42. Antitoxins, their properties, mechanism of action. Principles of obtaining antitoxic serums. Units of measurement, practical use.
43. Serological reactions, their characteristics, main types, practical use. Agglutination reaction, its mechanism, types. Practical use.
44. Serological reactions. Precipitation reaction, its mechanism. Use in medical practice. Gel precipitation reaction.
45. Serological reactions. Lysis reactions. Complement fixation reaction, its practical use.
46. Reactions with labeled antibodies or antigens. Practical use of immunofluorescence test (IFT), enzyme-linked immunosorbent assay and radioimmunoassay.
47. Genetic research methods (PCR, DNA probe method, immunoblotting, molecular hybridization method).
48. Forms and types of immune response. Humoral immune response and its stages.
49. Primary and secondary immune response. Interaction of cells of the immune system in the process of immune response.
50. Immune response reactions, their characteristics. Cellular immune response.
51. Immediate and delayed type hypersensitivity. The mechanism of development of these reactions.
52. Monoclonal antibodies, their production and use in medical practice.
53. Immunodeficiency states, autoimmune processes. Comprehensive assessment of the immune status of the organism.
54. Live vaccines, principles of production. Control, practical use of live vaccines, evaluation of effectiveness.
55. Vaccines. Obtainment history. Classification of vaccines. Corpuscular, chemical, synthetic, genetically engineered, anti-idiotypic vaccines, liposomal and encapsulated, mucosal, ribosomal and RNA vaccines, from transgenic plants.
56. Vaccines. Classification of vaccines. Genetically engineered, anti-idiotypic vaccines, liposomal and encapsulated, mucosal, ribosomal and RNA vaccines, from transgenic plants.
57. Chemical vaccines and toxoids, principles of production. Associated vaccines. Adsorbed vaccines, the principle of "depot".
58. Toxoids, their production, purification, units, use, evaluation.
59. Corpuscular vaccines from killed microbes. Principles of obtaining, control, evaluation of efficiency.

LIST OF THEORETICAL QUESTIONS FOR THE FINAL MODULE CONTROL №2

1. Modern methods of diagnosing infectious diseases. Reactions using labeled antigens and antibodies: Immunofluorescence reaction (direct and indirect). Practical use of the reaction.
2. Modern methods of diagnosis of infectious diseases. Reactions with using of labeled antigens and antibodies: Enzyme-linked immunosorbent assay (direct, indirect, solidphase, competitive). Immunoblotting. Practical use of reactions.
3. Modern methods of diagnosing infectious diseases. Reactions using labeled antigens and antibodies: Radioimmunoassay (competitive, reverse, indirect). Practical use of reactions.
4. Genetic methods in the diagnosis of infectious diseases and in the identification of pathogens:
a) DNA sequence, polymerase chain reaction; b) hybridization of nucleic acids. Biochips. Application in diagnostics.
5. History of discovery and main stages of development of virology. The contribution of Ukrainian scientists. Methods of studying viruses, their evaluation.
6. Principles of virus classification. The main properties of human and animal viruses.
7. The kingdom of viruses. Definition of viruses as special forms of living organization. Principles of structural organization of viruses.
8. Virion and its components. Nucleocapsid, capsid, capsomeres, supercapsids (peplos), peplomers.
9. Simple and complex viruses.
10. Chemical composition of viruses: nucleic acids, proteins, lipids, polysaccharides. Their features and functions. Virus enzymes, their role, classification.
11. Reproduction of viruses in the process of their interaction with the cell. The main stages of interaction of viruses with cells in productive infection.
12. Integrative and abortive types of interaction of viruses with the host cell.
13. Methods of culturing viruses and their evaluation.
14. Methods of culturing viruses in chicken embryos, in the body of laboratory animals.
15. Indication of viral reproduction by hemagglutination reaction. Mechanism, practical significance, use, diagnostic value.
16. Indication of viral reproduction by hemadsorption reaction. Mechanism, practical significance, use, diagnostic value.
17. The use of cell cultures in virology. Classification of cell cultures. Nutrient media for cell cultures.
18. Methods of culturing viruses in cells. Classification of cell cultures used in virology, their characteristics.
19. Methods of detection (indication) of viral reproduction by cytopathogenic action, plaque formation under agar coating, viral inclusions.
20. Types of interaction between viruses and cells. Characteristics of productive interaction, stages.
21. Genetic methods for determining viruses and their nucleic components.
22. Features of serological reactions used in virology. Double-antibody technique.
23. Features of diagnosis of viral infections. Complement fixation test and features in virology. Complement fixation test, its essence, evaluation. Features of complement fixation test in viral infections.
24. Hemagglutination inhibition reaction, its mechanism, technique, principles of use, diagnostic value.
25. Virus neutralization reaction, its mechanism, technique, principles of use, diagnostic value.
26. Nonspecific factors of protection of a macroorganism from viral agents, their characteristics. Interferons, mechanism of action, interferonogens.

27. Viral vaccines, classification, principles of obtaining, requirements for them, control, evaluation of effectiveness.
28. Bacteriophage, history of study. Structure, classification of phages by morphology. Chemical composition.
29. Bacteriophages. Structure, classification. Methods of qualitative and quantitative determination of bacteriophages.
30. Forms of interaction of bacteriophages with a bacterial cell. Characteristics of productive interaction.
31. Virulent and moderate phages.
32. Stages of the productive type of interaction of bacteriophages with bacterial cells.
33. Bacteriophages. Lysogeny and phage conversion.
34. Practical use of bacteriophages in microbiology and medicine.
35. Features of the pathogenesis of viral infections. Acute and persistent viral infections
36. Immunological features of viral infections. Factors of antiviral immunity.
37. Oncogenic viruses, classification. Viral-genetic theory of tumors by L. Zilber. Mechanisms of viral carcinogenesis.
38. Family of Orthomyxoviruses. General characteristics, biological properties, classification. Human influenza viruses. The structure of the virion. Genome features. Cultivation. Sensitivity to physical and chemical factors.
39. Characteristics of human influenza virus antigens. Hemagglutinins, neuraminidases, functional activity. Classification of human influenza viruses. Types of antigenic variability of influenza viruses, its mechanisms.
40. Pathogenesis and immunity to influenza. The role of specific and nonspecific mechanisms in influenza immunity.
41. Methods of laboratory diagnosis of influenza and their evaluation. The problem of specific prevention and treatment of influenza. Preparations and their evaluation.
42. Family of Paramyxoviruses, general characteristics of the family. Parainfluenza viruses, their biological properties. Role in the development of human pathology. Laboratory diagnosis of parainfluenza infections.
43. Genus of paramyxoviruses (Paramyxovirus). Mumps virus. Role in human pathology. Immunity. Specific prevention.
44. Genus of morbilliviruses (Morbillivirus). Measles virus, biological properties Pathogenesis of the disease. Immunity and specific prevention.
45. Genus of paramyxoviruses (Paramyxovirus). Genus of pneumoviruses (Pneumovirus). Human respiratory syncytial virus. Biological properties. Pathogenesis of the disease. Immunity.
46. Picornavirus family, general characteristics. Antigenic structure. Biological features of Coxsackie viruses, ECHO, enteroviruses 68 - 71st types, properties. Significance in the development of human pathology.
47. Polio viruses, characteristics, classification. Pathogenesis and immunogenesis of infection.
48. Laboratory diagnosis, specific polio prevention. The problem of polio eradication worldwide.
49. Genus of Rhinoviruses, biological properties. Classification. Role in human pathology. Methods of laboratory diagnosis of infections caused by rhinoviruses.
50. Genus of Aphthoviruses (Aphthovirus). Foot-and-mouth disease viruses. Biological properties. Classification. Pathogenesis of infection in humans. Laboratory diagnosis, specific prevention.
51. Reoviruses (family Reoviridae). General characteristics. Classification. Role in human pathology. Genus of rotavirus (Rotavirus). Classification, properties. Role in human pathology. Laboratory diagnosis.
52. Family of Rhabdoviruses. Rabies virus. The structure of the virion. Cultivation. Sensitivity to physical and chemical factors. Pathogenicity to humans and animals. Laboratory

- diagnosis. Intracellular inclusions (Babes-Negri bodies). Specific prevention.
53. Genus Vesiculovirus. Vesicular stomatitis virus, its role in human pathology, diagnosis.
54. General characteristics of the ecological group of arboviruses. Tick-borne encephalitis viruses. Japanese encephalitis viruses. Biological properties, methods of laboratory diagnosis, specific prevention.
55. Cardioviruses. General characteristics.
56. Retroviruses (family Retroviridae). General characteristics. Biological properties. Classification. Representatives of the subfamilies Oncovirinae, Lentivirinae, and Spumavirinae.
57. Human immunodeficiency virus (HIV). Morphology and chemical composition. Genome features. Variability, its mechanisms. Types of HIV. Origin and evolution.
58. Human immunodeficiency virus (HIV). Cultivation, stages of interaction with sensitive cells. Sensitivity to physical and chemical factors.
59. Pathogenesis of HIV infection. Target cells in the human body, characteristics of surface receptors. The mechanism of immunodeficiency development.
60. AIDS-associated pathology (opportunistic infections and tumors).
61. HIV infection. Principles of treatment. Prospects for specific prevention.
62. Human immunodeficiency viruses (HIV). Methods of laboratory diagnosis (immunological, genetic).
63. Herpes viruses pathogenic to humans: herpes simplex virus types 1 and 2. Biological properties. Role in pathology.
64. Herpes viruses pathogenic to humans: chickenpox - shingles. Biological properties. Role in pathology.
65. Cytomegalovirus (CMV). Biological properties. Role in pathology.
66. Herpes viruses pathogenic to humans: Epstein-Barr herpesvirus (EB) - the causative agent of infectious mononucleosis, human cancer. Human herpes viruses of 6, 7, 8 types. Biological properties. Role in pathology.
67. Family of Adenoviruses. Biological properties. Antigenic structure. Cultivation. Pathogenesis and laboratory diagnosis of adenoviral infections. Immunity. Specific prevention.
68. Smallpox virus. Pathogenesis of infection. Methods of diagnosis and specific prevention. Vaccinia virus. Elimination of smallpox worldwide.
69. Pathogens of viral hepatitis A, properties and classification of viruses. Pathogenesis of diseases. Laboratory diagnostics. Specific prevention.
70. Pathogens of viral hepatitis B, properties and classification of viruses. Pathogenesis of diseases. Laboratory diagnosis. Specific prevention.
71. Pathogens of viral hepatitis C, properties and classification of viruses. Pathogenesis of diseases. Laboratory diagnostics. Prospects for specific prevention.
72. Pathogens of viral hepatitis D, properties and classification of viruses. Pathogenesis of diseases. Laboratory diagnostics. Specific prevention.
73. Pathogens of viral hepatitis E, properties and classification of viruses. Pathogenesis of diseases. Laboratory diagnostics. Prospects for specific prevention.
74. Coronaviruses. Properties. SARS virus (SARS-CoV.). Diagnostic methods. Middle Eastern Respiratory Syndrome (MERS) virus. Diagnostic methods.
75. Filoviruses. Marburg and Ebola viruses. Properties. Treatment, prevention.
76. Emergent and re-emergent infections.
77. Prions. Properties. Prion diseases of animals (scrapie, spongiform encephalopathies of cows) and humans (Kuru, Creutzfeldt-Jakob disease (CJD), etc.). Pathogenesis of prion diseases. Diagnosis.
78. Practical use of bacteriophages in medicine for the prevention and treatment of infectious diseases.

*LIST OF THEORETICAL QUESTIONS FOR THE SEMESTER FINAL
CERTIFICATION*

1. Definition of microbiology as a science. Branches of microbiology. Subject and tasks of medical microbiology. The main features and trends of modern microbiology.
2. Discovery of microorganisms by A. Levenguk. Stages of development of microbiology. The contribution of L. Pasteur and R. Koch in microbiology.
3. Formation of the main directions of microbiological science. The role of D. Samoilovich, E. Jenner, II Mechnikov, D. Ivanovsky, P. Ehrlich, SM Vinogradsky
4. Bering, G. Ramon, F. Lesh, G. Domagko, O Fleming, DK Zaboltny, L.O. Zilber, VM Zhdanov, MP Chumakov, F. Burnett and other scientists. Development of microbiology in Ukraine.
5. The main differences between prokaryotes and eukaryotes. Forms of bacteria with a defect in the synthesis of the cell wall, protoplasts, spheroplasts. L-forms of bacteria.
6. Morphology and structure of bacteria. The role of certain structures for bacterial activity and in the pathogenesis of infectious diseases. Vegetative forms and spores.
7. Morphology and classification of protozoa.
8. Classification and morphology of fungi.
9. Methods of microscopy. Preparation of bacteriological smears. Dyes and dyeing solutions, simple and complex methods of stain.
10. Complex methods of staining microorganisms. Gram staining technique. Factors that affect the staining of microorganisms by Gram. The practical significance of the Gram staining method.
11. Principles of organization, equipment and mode of operation of bacteriological, serological and virological laboratories.
12. Bacterioscopic method of research. Stages.
13. Types and mechanisms of nutrition of microorganisms. Mechanisms of nutrient penetration into the bacterial cell. Chemical composition of microorganisms. The value of the components.
14. Nutrient media, requirements for them. Classification of nutrient media used in microbiology.
15. Respiration of microorganisms. Aerobic and anaerobic types of respiration. Enzymes and cell structures involved in the process of respiration. Methods of growing anaerobic bacteria.
16. Enzymes of microorganisms, their role in metabolism. Use for bacterial differentiation. Pathogenicity enzymes.
17. Growth of bacteria and methods of bacterial reproduction. Mechanism of cell division, phases of reproduction of bacterial culture in stationary conditions.
18. Bacteriological method of research. Principles of isolation of pure cultures of bacteria and their identification.
19. Effect of physical, chemical and biological factors on microorganisms. Sterilization, methods, control over sterilization efficiency. Asepsis. Antisepsis.
20. Extrachromosomal factors of bacterial heredity. Plasmids, their main genetic functions. Migrating elements. Integrons and super-integrons. The role of mutations, recombination and selection in microbial evolution. The main factors of evolution.
21. Chemotherapy and chemotherapeutic drugs. Chemotherapeutic index. The mechanism of antibacterial action of sulfonamides. The role of P. Ehrlich and G. Domagko on the development of the theory of chemotherapy.
21. The phenomenon of microbial antagonism. The role of Ukrainian microbiologists in the development of the doctrine of microbial antagonism. Antibiotics, characteristics, principles of production, units of measurement. Classification by mechanism of action on microorganisms.
22. Antibiotics, classification by origin, by nature, by mechanism and spectrum of antimicrobial action.

23. 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 meaning. Principles of combating drug resistance of microorganisms.
24. **Complications of antibiotic therapy. Dysbiosis. Antibiotic-resistant, antibioticdependent and antibiotic-tolerant strains of bacteria.**
25. Infection. Factors that cause the occurrence of the infectious process. The role of microorganisms in the infectious process. Pathogenicity, virulence, units of measurement, methods of determination. Factors of pathogenicity of microorganisms, their characteristics.
26. **Microbial toxins (exo- and endotoxins). Properties and chemical composition, production, measurement of exotoxin strength. Role in the pathogenesis and immunogenesis of infectious diseases.**
27. Phases of development of the infectious process. Mechanisms of infection with pathogenic microorganisms. Bacteremia, toxinemia, sepsis. Periods of infectious disease.
28. **The role of the macroorganism in the infectious process. Immunological reactivity of the child's body. The influence of the environment and social conditions on the emergence and development of the infectious process in humans. Persistence of bacteria and viruses. The concept of relapse, reinfection, superinfection.**
29. The doctrine of immunity. Stages of development of immunology. Types of immunity and forms of its manifestation.
30. Nonspecific factors of protection of an organism against pathogenic microbes. Complement, its properties, activation pathways. Cytokines.
31. Nonspecific factors of protection of an organism against pathogenic microbes. Stages of phagocytosis. Complete and incomplete phagocytosis. The doctrine of Tollreceptors of phagocytes.
32. The body's immune system, its organs. The role of the thymus gland in the immune response. Cells of the immune system, their varieties, the interaction of T-, Blymphocytes and macrophages. Their role in cellular and humoral immunity.
33. **Cells of the immune system, their varieties, the interaction of T-, B-lymphocytes and macrophages. Their role in cellular and humoral immunity.**
34. Patterns of the body's immune response. Phases of the immune response. Immunological reactions. Immunological tolerance, causes of its occurrence. Immunological memory, its mechanism.
35. Immediate and delayed hypersensitivity, their mechanisms, differences. Practical meaning.
36. **Tricellular system of immune response cooperation. The role of individual cells of the immune system, their interaction. Interleukins.**
37. Antigens, their characteristics. Complete and incomplete antigens. Antigenic structure of bacteria. The practical significance of the doctrine of microbial antigens. Autoantigens.
38. **Antibodies, their nature. Place of synthesis, dynamics of antibody production.**
39. **Plasmocytes: the concept of "plasma cell clone". Autoantibodies.**
40. Antitoxins, their properties, mechanism of action. Principles of obtaining antitoxic serums. Units of measurement, practical use.
41. Serological reactions, their characteristics, main types, practical use. Agglutination reaction, its mechanism, types. Practical use.
42. Serological reactions. Precipitation reaction, its mechanism. Use in medical practice. Gel precipitation reaction.
43. Serological reactions. Lysis reactions. Complement fixation reaction, its practical use.
44. Reactions with labeled antibodies or antigens. Practical use of immunofluorescence test (IFT), enzyme-linked immunosorbent assay and radioimmunoassay.

45. Genetic research methods (PCR, DNA probe method, immunoblotting, molecular hybridization method).
46. Forms and types of immune response. Humoral immune response and its stages.
47. Primary and secondary immune response. Interaction of cells of the immune system in the process of immune response.
48. Immune response reactions, their characteristics. Cellular immune response.
49. Immediate and delayed type hypersensitivity. The mechanism of development of these reactions.
50. Monoclonal antibodies, their production and use in medical practice.
51. Immunodeficiency states, autoimmune processes. Comprehensive assessment of the immune status of the organism.
52. Live vaccines, principles of production. Control, practical use of live vaccines, evaluation of effectiveness.
53. Vaccines. Obtainment history. Classification of vaccines. Corpuscular, chemical, synthetic, genetically engineered, anti-idiotypic vaccines, liposomal and encapsulated, mucosal, ribosomal and RNA vaccines, from transgenic plants.
54. Chemical vaccines and toxoids, principles of production. Associated vaccines. Adsorbed vaccines, the principle of "depot".
55. Toxoids, their production, purification, units, use, evaluation.
56. Corpuscular vaccines from killed microbes. Principles of obtaining, control, evaluation of efficiency.
57. History of discovery and main stages of development of virology. The contribution of Ukrainian scientists. Methods of studying viruses, their evaluation.
58. Morphology and ultrastructure of viruses. Types of symmetry of viruses. Chemical composition, functions of components of viruses.
59. Bacteriophage, history of study. Structure, classification of phages by morphology. Methods of qualitative and quantitative determination of bacteriophages. Practical use of bacteriophages.
60. Forms of interaction of bacteriophages with a bacterial cell. Virulent and moderate phages. Characteristics of productive interaction. Lysogeny and phage conversion.
61. Current thinking on the nature and origin of viruses. The place of viruses in the living system. Principles of virus classification. The main properties of human and animal viruses.
62. Methods of culturing viruses and their evaluation. The use of cell cultures in virology. Classification of cell cultures. Nutrient media for cell culture.
63. Viral hemagglutination and hemadsorption reactions. Mechanism, practical significance, use, diagnostic value.
64. Serological reactions used in virology. Virus neutralization reaction, mechanism, principles of use, diagnostic value.
65. Hemagglutination inhibition reaction, its mechanism, production conditions, principles of use, diagnostic value.
66. Complement fixation test, its essence, evaluation. Features of complement fixation reaction in viral infections.
67. Reactions with labeled antibodies and antigens in virology. Immunofluorescence reaction (RIF).
68. Types of interaction between viruses and cells. Characteristics of productive interaction, stages.
69. Features of the pathogenesis of viral infections. Acute and persistent viral infections.
70. Immunological features of viral infections. Factors of antiviral immunity.
71. Methods of virus detection in cell culture and their evaluation. Cytopathogenic action of viruses, its types.

72. Nonspecific factors of protection of a macroorganism against viral agents, their characteristics. Interferons, mechanism of action, interferonogens.
73. Viral vaccines, classification, principles of obtaining, requirements for them, control, evaluation of effectiveness.
74. Family of **Orthomyxoviruses**. History of discovery, biological properties, classification.
75. Methods of laboratory diagnosis of influenza and their evaluation.
76. Antigenic structure and types of antigenic variability of influenza virus. Modern hypotheses that explain the antigenic variability of **orthomyxoviruses**.
77. **Pathogenesis and immunity to influenza**. The role of specific and nonspecific mechanisms in influenza immunity. The problem of specific prevention and treatment of influenza. Drugs and their evaluation.
78. **Paramyxovirus family**. Measles virus, biological properties, cultivation. Pathogenesis of infection. Laboratory diagnostics, specific prevention.
79. **Mumps virus**. Pathogenesis of infection. Laboratory diagnosis, specific prevention of mumps.
80. **Paramyxovirus family**. General characteristics. Respiratory syncytial virus. Biological properties, role in the development of human pathology. Methods for diagnosing diseases caused by MS viruses.
81. **Picornavirus family**, general characteristics. Antigenic structure. Biological features of **Coxsackie viruses**, properties. Significance in the development of human pathology. Genus of **enteroviruses**, general characteristics, classification. Laboratory diagnosis of enterovirus infections.
82. **Polio viruses**, characteristics, classification. Pathogenesis and immunogenesis of infection. Laboratory diagnostics, specific prevention. The problem of polio eradication worldwide.
83. Genus of **Rhinoviruses**, biological properties. Classification. Role in human pathology. Methods of laboratory diagnosis of infections caused by **Rhinoviruses**.
84. **Rhabdovirus family**. Rabies virus, biological properties. Pathogenesis of the disease. Laboratory diagnostics. Differentiation of fixed and wild rabies virus. Specific rabies prevention.
85. General characteristics of the ecological group of **Arboviruses**. Tick-borne and Japanese encephalitis viruses. History of the discovery and study of these viruses. Biological properties, methods of laboratory diagnostics, specific prevention.
86. Genus **Rubiviruses**. Rubella virus. Biological properties. Pathogenesis of the disease, immunity. Laboratory diagnostics, specific prevention.
87. **Herpesvirus family**, biological properties, importance in the development of human pathology. Laboratory diagnosis of diseases. Genetic diagnostic methods.
88. **Adenovirus family**. Biological properties. Antigenic structure. Cultivation. Pathogenesis and laboratory diagnosis of adenoviral infections. Immunity. Specific prevention.
89. **Smallpox virus**. Pathogenesis of infection. Methods of diagnosis and specific prevention. **Vaccinia virus**. Elimination of smallpox worldwide.
90. **Pathogens of viral hepatitis A and E**, properties and classification of viruses. Pathogenesis of diseases. Laboratory diagnostics. Prospects for specific prevention.
91. **Pathogens of viral hepatitis B, D, C**, properties and classification of viruses. Pathogenesis of diseases. Laboratory diagnostics. Prospects for specific prevention.
92. **Oncogenic viruses**, classification. Viral-genetic theory of tumors by L.O. Zilber. Mechanisms of viral carcinogenesis.
93. **Retroviruses family**, biological properties. Classification. The mechanism of viral carcinogenesis. Human immunodeficiency viruses (HIV). Properties. Role in human pathology. The pathogenesis of AIDS. Methods of laboratory diagnostics (immunological, genetic). Prospects for specific prevention and therapy.
94. **Cardioviruses**. General characteristics.

95. Coronaviruses. Properties. SARS virus (SARS-CoV.). Middle Eastern Respiratory Syndrome (MERS) virus. Diagnostic methods.
96. Filoviruses. Marburg and Ebola viruses. Properties. Treatment, prevention.
97. Emergent and re-emergent infections.
98. Prions. Properties. Prion diseases of animals (scrapie, spongy encephalopathy of cows) and humans (Kuru, Creutzfeldt-Jakob disease (CJD), etc.). Pathogenesis of prion diseases. Diagnosis.
99. Evolution of cocci, their general characteristics. Staphylococci, biological properties, classification, practical significance.
100. The role of staphylococci in the development of human pathology, the pathogenesis of the processes caused by them. Characteristics of toxins and pathogenic enzymes. Role in the occurrence of nosocomial infection.
101. Methods of microbiological diagnosis of staphylococcal infections and their evaluation. Immunity in staphylococcal diseases. Drugs for specific prevention and therapy, evaluation.
102. Streptococci, biological properties, classification. Toxins, enzymes of pathogenicity.
103. Streptococcus pneumoniae, biological properties. Pathogenicity to humans and animals. Microbiological diagnosis of pneumococcal diseases.
104. Streptococci. Role in the development of human pathology. Pathogenesis of streptococcal diseases. Toxins and enzymes of pathogenicity of streptococci. Immunity. Methods of microbiological diagnosis of streptococcal diseases.
105. Meningococci, biological properties, classification. Pathogenesis and microbiological diagnosis of meningococcal diseases and bacteriocarriers. Differentiation of meningococci from gram-negative diplococci of the nasopharynx.
106. Gonococci. Biological properties, pathogenesis and microbiological diagnosis of diseases. Prevention and specific therapy of gonorrhea and blenorrhea.
107. Enterobacteria, their evolution. Significance in the development of human pathology. Microbiological diagnosis of coli enteritis. Escherichia coli, their properties. Pathogenic serovars of Escherichia coli, their differentiation. Microbiological diagnosis of coli enteritis.
108. Pathogenetic bases of microbiological diagnostics of typhoid fever and paratyphoid fever A and B. Methods of microbiological diagnosis, their estimation.
109. Salmonella - pathogens of typhoid fever and paratyphoid A and B. Biological properties, antigenic structure. Pathogenesis of diseases. Immunity. Specific prevention and therapy.
110. Salmonella - the causative agents of acute gastroenteritis, their properties. Principles of classification. Pathogenesis of food toxicoinfections of salmonellosis nature. Microbiological diagnostics.
111. Genus Shigella, biological properties, classification. Pathogenesis of dysentery.
112. Shigella. Role in human pathology. Pathogenesis of dysentery, the role of toxins and pathogenic enzymes. Immunity. Methods of microbiological diagnosis of dysentery, their evaluation.
113. Vibrio cholerae, biological properties, biovars. Pathogenesis and immunity in cholera. Methods of microbiological diagnosis of cholera and their evaluation. Specific prevention and treatment of cholera.
114. Yersinia. The causative agent of plague, the history of the study, biological properties. The role of Ukrainian 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 yersiniosis.
115. The causative agent of tularemia, biological properties. Pathogenesis, immunity, methods of microbiological diagnosis and specific prevention of tularemia.

116. *Brucella*, species, differentiation. Pathogenesis and immunity in brucellosis. Methods of microbiological diagnosis of brucellosis, their evaluation. Drugs for specific prevention and therapy.
117. *Klebsiella*, their role in human pathology. Characteristics of *Klebsiella pneumoniae*, *ozeana*, *rhinoscleroma*. Microbiological diagnostics, specific prevention.
118. *Bordetella*, their properties. The causative agent of pertussis, morphological, cultural, antigenic properties. Microbiological diagnosis and specific prevention of pertussis.
119. Anthrax bacilli. Biological features, pathogenesis, microbiological diagnosis and specific prevention of anthrax. The role of Ukrainian scientists in obtaining of drugs for specific prevention of anthrax.
120. General comparative characteristics of anaerobic bacteria, their importance in the development of human pathology. Features of microbiological diagnosis of diseases caused by anaerobes. Anaerobic non-clostridial bacteria (*bacteroids*, etc.), their biological properties.
121. *Clostridium tetanus*, properties. Toxin formation. Pathogenesis of tetanus in humans. Microbiological diagnostics, specific prevention and therapy, their theoretical substantiation and assessment.
122. *Clostridium botulinum*. Morphological and cultural features, antigenic structure, toxin formation, classification. Pathogenesis, microbiological diagnosis and therapy of botulism.
123. Pathogens of anaerobic wound infection, properties, classification. Pathogenesis and microbiological diagnosis. Methods of specific prevention and treatment of anaerobic wound infection.
124. *Corynebacteria*, characteristics. Evolution of *corynebacteria*. Biovars of diphtheria bacilli. Toxin formation, genetic determinants of toxigenicity. Measurement of toxin strength.
125. Stages of development of the doctrine of the causative agent of diphtheria. Theoretical bases of specific diphtheria prevention. Diphtheria drugs.
126. Pathogenesis of diphtheria, immunity. Microbiological diagnosis of bacteriocarriers. Differentiation of the causative agent of diphtheria and saprophytic *corynebacteria*.
127. The causative agent of diphtheria, biological properties. Characteristics of exotoxin. Specific prevention and treatment of diphtheria. Detection of antitoxic immunity.
128. Pathogenic mycobacteria, role in the development of human pathology. Pathogens of tuberculosis, properties. Types of tuberculosis bacteria. Pathogenesis and microbiological diagnosis of tuberculosis.
129. Microbiological diagnosis of tuberculosis. Immunity in tuberculosis. Specific prevention and treatment of tuberculosis. The causative agent of leprosy, biological features.
130. *Mycobacteria* of tuberculosis, properties. Types of tuberculosis bacteria. Tinctorial and cultural properties. Differentiation of tuberculosis pathogens. Atypical mycobacteria. Significance in the development of human pathology.
131. Pathogenic fungi and actinomycetes (pathogens of candidiasis, dermatomycosis, actinomycosis, their characteristics). Principles of microbiological diagnosis of mycosis.
132. The causative agent of syphilis. Morphological, cultural properties. Pathogenesis and immunity. Microbiological diagnosis and specific therapy of syphilis.
133. *Leptospira*, their characteristics, classification. Pathogenesis, immunity and microbiological diagnosis of leptospirosis. Specific prevention and therapy.
134. *Borrelia*, biological properties. Role in the development of human pathology. Pathogens of epidemic and endemic relapsing fever. Pathogenesis, immunogenesis and microbiological diagnosis of typhoid fever. Specific prevention and treatment of recurrent typhus. The causative agent of Lyme disease. Pathogenesis of the disease, microbiological diagnosis, therapy and prevention.

135. Rickettsiae, biological properties. Classification. Rickettsiae pathogens in humans. The causative agent of Q fever. Pathogenesis of the disease, laboratory diagnosis, specific prevention.
136. Pathogens of typhus, properties. Pathogenesis of the disease, evaluation of methods. Specific prevention, evaluation of drugs. Laboratory diagnostics.
137. Mycoplasma, classification. Biological properties, cultivation methods. Role in the development of human pathology. Microbiological diagnosis of mycoplasmosis.
138. Chlamydia, classification, biological properties. Cultivation methods. Role in the development of human pathology. Microbiological diagnosis of chlamydia.
139. Pathogenic spiral-shaped bacteria. The causative agent of rat-bite fever (RBF). Microbiological diagnosis of the disease.
140. Campylobacter - the causative agent of acute intestinal diseases. Biological properties, microbiological diagnostics.
141. Helicobacter pylori - the causative agent of human gastroduodenal diseases. Discovery, biological properties, pathogenesis. Methods of microbiological diagnostics. Modern methods of treatment of Helicobacter pylori infection.
142. Modern methods of laboratory diagnosis of infectious diseases.
143. Conditionally pathogenic microorganisms, biological properties, etiological role in the development of opportunistic infections. Characteristics of diseases caused by opportunistic pathogens.
144. Nosocomial infection, conditions of its occurrence. Properties of hospital ecovars of microorganisms. Microbiological diagnosis of purulent-inflammatory, burn infections and wound infections caused by hospital strains.
145. Clinical microbiology. Object of research. Subject, tasks, methods. Criteria for the etiological role of opportunistic pathogens isolated from the pathological focus.
146. Normal microflora of the human body, its role in physiological processes and the emergence of human pathology. Age features of the normal microflora of the nose, skin, mouth, genitals, intestines. Gnotobiology. Dysbiosis and its causes.
147. Probiotics and eubiotics, their characteristics, mechanism of action.
148. Water microflora. Survival of pathogenic microorganisms in water. The role of water in the transmission of infectious diseases. Sanitary and bacteriological control over drinking water quality, sanitary-indicatory microorganisms.
149. Soil microflora. The role of soil in the transmission of infectious diseases. Factors affecting the survival of pathogenic microorganisms in the soil. Sanitary-indicative microorganisms used in the assessment of soil contamination. Methods of sanitary-microbiological research of soil.
150. Air microflora, its characteristics. The role of air in the transmission of infectious diseases. Microbial number and sanitary-indicative microorganisms of indoor air, methods of determination, their evaluation.
151. Sanitary-indicative microorganisms of air, methods of their detection. Criteria for assessing the purity of indoor air.
152. Pathogens of food poisoning. Principles of sanitary and bacteriological research of food products.
153. The role of water, soil, air in the transmission of viral infections. Viruses that are most often found in the environment.
154. The role of the air environment in the spread of pathogens of respiratory viral infections. Methods of air sampling and indication of respiratory viruses.
155. Modern methods of laboratory diagnosis of infectious diseases.

List of practical skills for final module control

1. Observe and evaluate the results of a hemagglutination test (HGA) to determine the presence of parainfluenza virus in an infected chicken embryo. Conclude.
2. Observe and evaluate the results of phage identification of blood culture isolated from a patient with suspected typhoid fever. Conclude.
3. Observe and evaluate the results of titration of intestinal bacteriophage in open water by the method of Apelman.
4. Observe and evaluate the results of the hemagglutination inhibition reaction (RGGA) of the patient's paired sera and the standard mumps standard antigen. Conclude.
5. Observe and evaluate of enzyme-linked immunosorbent assay (ELISA), performed with the sera of the patient to detect antibodies to HIV antigens (anti gr 120). Conclude.
6. Observe and evaluate the results of the neutralization reaction (NR) - a color test performed with paired sera of the patient and standard antigen - a strain of polio virus type 1. Conclude.
7. Observe and evaluate the results of the complement fixation test (CFT) performed with the patient's paired sera and standard specific adenoviral antigen. Conclude.
8. Observe and evaluate the results of the neutralization reaction (NR) - a color test, in order to seroidentify the selected polio virus strain. Conclude.
9. Observe and evaluate the results of the hemagglutination inhibition reaction (HAIR) performed with paired sera of the patient and the standard viral antigen (reference strain of influenza virus H1N1). Conclude.
10. Observe and evaluate the results of the hemagglutination inhibition reaction (HAIR), performed for the purpose of ceroidification of the isolated strain of influenza virus. Conclude.
11. Observe and evaluate the results of enzyme-linked immunosorbent assay (ELISA) of sera of pregnant women to detect IgM to herpes simplex virus antigens. Conclude.
12. Observe and evaluate the results of enzyme-linked immunosorbent assay (ELISA) performed with the sera of the patient to detect IgG to HSV-1 antigens. Conclude.
13. Observe and evaluate the results of enzyme-linked immunosorbent assay (ELISA), performed with the sera of patients to detect Ig M to antigens hepatitis A virus.

LIST OF PRACTICAL SKILLS FOR THE SEMESTER FINAL CERTIFICATION

1. Microscopy of the smear, determine the method of staining, morphology and tinctorial properties of bacteria. Smears for microscopy: 1) staphylococcus; 2) streptococcus; 3) monobacteria; 4) capsulated bacteria; 5) spores stained by Ozheshko; 6) spores stained by Peshkov; 7) spores stained by Gram; 8) yeast-like fungi; 9) incompleting phagocytosis of diplococci.
2. Prepare a smear from a culture of bacteria grown on a dense nutrient medium, stained by Gram. Microscopy, determine morphology and tinctorial properties.
3. Prepare a smear from a culture of bacteria grown on a dense nutrient medium, stained by a simple method. Microscopy, determine morphology.
4. Prepare a smear from the patient's sputum, stain according to Ziehl-Neelsen, microscopy, determine the morphology.
5. Describe the cultural properties of bacteria under conditions of their growth on a solid nutrient medium.
6. The basic composition and mechanism of action of the Endo media. Practical use.
7. The composition and mechanism of action of Levin's media. Practical use.
8. The basic composition and mechanism of action of Ploskirev's media. Practical use.
9. Practical application of the Kitta-Tarozzi media, the basic composition and mechanism of action.

10. Observe and evaluate the biochemical properties of the selected pure bacterial culture. Conclude.
11. Observe and evaluate the sensitivity of staphylococcal culture to antibiotics by the method of diagnostic discs. Evaluate, conclude.
12. Observe and evaluate the minimum inhibitory concentration of cefazolin for staphylococcal culture by the method of serial dilutions. Evaluate, conclude.
13. Perform the reaction of thermo-ring precipitation by Ascoli in order to detect antigens of the anthrax pathogen in the studied extract from animal raw materials. Evaluate, conclude
14. Make the agglutination reaction on a glass with an unknown culture of bacteria and typhoid diagnostic agglutinating serum. Observe, evaluate, conclude.
15. Observe and evaluate of CFT with the patient's serum and gonococcal standard antigen, Evaluate, conclude.
16. Observe and evaluate the results of the gel precipitation reaction, performed to determine the toxigenicity of the studied cultures of *Corynebacterium diphtheria*.
17. Observe and evaluate the results of a serial dilution agglutination test with the patient's serum and typhoid standard antigen.
18. Observe and evaluate the results of the indirect hemagglutination test (IHA) of the patient's serum with erythrocyte tularemia standard antigen.
19. Observe and evaluate the results of enzyme-linked immunosorbent assay (ELISA) to detect antibodies to antigens of the syphilis pathogen.
20. Observe and evaluate the microbial number of drinking water.
21. Observe and evaluate the coli-index and coli-titer of drinking water by the method of membrane filters. Conclude.
22. Observe and evaluate the total microbial number of the air in the classroom by the sedimentation method.
23. Observe and evaluate the culture of urine, which made by the sector method (by Gold) and estimate the degree of its microbial content (bacteriuria) according to the rated table.
24. Microscopy a smear made from vaginal secretions of a pregnant woman, determine the degree of purity of the vaginal secretion of the patient.
25. Observe and evaluate of phagotyping of staphylococcal strains, which are isolated from: a) postoperative patient; b) and c) – from persons of the medical staff of the surgical department. Identify the phage group. Conclude.

8. TEACHING METHODS

1. Verbal (lecture, explanation, story, conversation, instruction);
 2. Visual (observation, illustration, demonstration);
 3. Practical (different types of exercises, graphic works, experiment, practice).
- The training process uses the following teaching methods:
- explanatory-illustrative or informational-receptive, which provides for the ready presentation of information by the teacher and its assimilation by students;
 - reproductive, which is based on the performance of various types of tasks on the sample;
 - method of a problem statement - the teacher puts the problem and he solves it, demonstrating the contradictions that characterize the process of cognition, the task of students is to monitor the sequence of presentation, evidence of materiality, the prediction of the next steps of the teacher; the MN is implemented by teaching students to problem situations to ensure successful preliminary preparation for upcoming work in real conditions of practical medical institutions;
 - partially search or heuristic, aims at the mastery of the separate elements of search activity, for example: the teacher formulates the problem, students hypothesis;
 - research, the essence of which is to organize teacher search creative activity of students by setting new problems and problem tasks.

- methods to ensure the perception and assimilation of knowledge by students (lectures, independent work, instruction, consultation);
- methods of application of knowledge and acquisition and consolidation of skills (practical sessions, assignments);
- methods of verification and assessment of knowledge and skills.

9. METHODS OF CONTROL

9.1. Current control is performed based on the control of theoretical knowledge, skills and abilities in practical classes. Independent study students are assessed in practical classes, and is an integral part of the final grade of the student. Current control is performed during the training sessions and aims at checking the assimilation of students learning the material. Forms of current control are:

- a) test tasks with a choice of one correct answer, with the definition of the correct sequence of actions, with determination of the conformity, defining the specific portion of the photo or diagram ("detection");
- b) individual oral questioning, interview;
- c) the solution of typical situational tasks;
- g) identification of pathogens and carriers of pathogens of parasitic diseases in the photographs, macro - and micropreparats;
- d) control of practical skills;
- e) the typical problems of microbiology, virology and immunology.

9.2. Form of final control of education is carried out in the form of the exam (written, oral) (second semester).

The semester examination is a form of final control of mastering by the student the theoretical and practical material of the discipline. The final control (exam) is held on the last control class.

To FC allowed students who attended all included in the curriculum for the discipline of classroom training and the study module scored points not less than the minimum (**72 points**). A student who for good or without good reason, had the missing classes, you are allowed to work on academic debt to a fixed term.

The form of the final control should be standardized and include control of theoretical and practical training.

10. SCHEME OF CALCULATION AND DISTRIBUTION OF POINTS RECEIVED BY APPLICANTS FOR HIGHER EDUCATION.

Evaluation of current educational activities. During the assessment of mastering each topic for the current educational activity of the student scores are set on a 4-point (national) assessment scale. This takes into account all types of work provided by the discipline program. The student must receive a score on each topic. Scores on the traditional scale are converted into points. The final assessment of the current academic activity is the arithmetic mean (the sum of scores for each lesson is divided by the number of lessons per semester) and translated into points according to **Table 1**.

The maximum number of points that a student can collect for current educational activity during semester in order to be admitted to the exam is **120 points**.

The minimum number of points that a student can collect for current educational activity during semester in order to be admitted to the exam is **72 points**.

Calculating of the number of points is based on obtained marks of student according to traditional scale while learning subject during the semester, by calculating the arithmetic mean (AM) that is rounded to two signs after comma.

Table 1. Conversion of the average score for the current activity into a multi-scale scale (for disciplines completed by credit)

| 4- point scale | 200- point scale | 4- point scale | 200- point scale | 4- point scale | 200- point scale | 4- point scale | 200- point scale |
|----------------|------------------|----------------|------------------|----------------|------------------|----------------|------------------|
| 5 | 200 | 4,47 | 179 | 3,94 | 158 | 3,42 | 137 |
| 4,97 | 199 | 4,45 | 178 | 3,92 | 157 | 3,4 | 136 |
| 4,95 | 198 | 4,42 | 177 | 3,89 | 156 | 3,37 | 135 |
| 4,92 | 197 | 4,4 | 176 | 3,87 | 155 | 3,35 | 134 |
| 4,9 | 196 | 4,37 | 175 | 3,84 | 154 | 3,32 | 133 |
| 4,87 | 195 | 4,35 | 174 | 3,82 | 153 | 3,3 | 132 |
| 4,85 | 194 | 4,32 | 173 | 3,79 | 152 | 3,27 | 131 |
| 4,82 | 193 | 4,3 | 172 | 3,77 | 151 | 3,25 | 130 |
| 4,8 | 192 | 4,27 | 171 | 3,74 | 150 | 3,22 | 129 |
| 4,77 | 191 | 4,24 | 170 | 3,72 | 149 | 3,2 | 128 |
| 4,75 | 190 | 4,22 | 169 | 3,7 | 148 | 3,17 | 127 |
| 4,72 | 189 | 4,19 | 168 | 3,67 | 147 | 3,15 | 126 |
| 4,7 | 188 | 4,17 | 167 | 3,65 | 146 | 3,12 | 125 |
| 4,67 | 187 | 4,14 | 166 | 3,62 | 145 | 3,1 | 124 |
| 4,65 | 186 | 4,12 | 165 | 3,6 | 144 | 3,07 | 123 |
| 4,62 | 185 | 4,09 | 164 | 3,57 | 143 | 3,05 | 122 |
| 4,6 | 184 | 4,07 | 163 | 3,55 | 142 | 3,02 | 121 |
| 4,57 | 183 | 4,04 | 162 | 3,52 | 141 | 3 | 120 |
| 4,55 | 182 | 4,02 | 161 | 3,5 | 140 | <3 | Not enough |
| 4,52 | 181 | 3,99 | 160 | 3,47 | 139 | | |
| 4,5 | 180 | 3,97 | 159 | 3,45 | 138 | | |

Evaluation of individual student tasks. Points for individual tasks are accrued only if they are successfully completed and defended. The number of points awarded for different types of individual tasks depends on their scope and significance, but not more than 10-12 points. They are added to the amount of points gained by the student in the classroom during the current educational activity. In no case may the total amount for current activities exceed 120 points.

Evaluation of independent work of students. Independent work of students, which is provided by the topic of the lesson together with the classroom work, is evaluated during the current control of the topic in the relevant lesson. Assimilation of topics that are submitted only for independent work is checked during the final module control.

Evaluation of final control.

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

The final control is considered credited if the student scored at least 60% of the maximum amount of points (for a 200-point scale - at least **50 points**).

Determining the number of points that a student scored in the discipline: the number of points that a student scored in the discipline is defined as the sum of points for the current academic activity and for the final control (exam).

Conversion of the number of points from the discipline into grades on the ECTS scale and on a four-point (traditional) scale

Scores from disciplines are independently converted into both the ECTS scale and the na

Table 2. Conversion of the average score for the current activity into a multi-point scale

(for disciplines completed by exam)

| 4- point scale | 120- point scale | 4- point scale | 120- point scale | 4- point scale | 120- point scale | 4- point scale | 120- point scale |
|----------------|------------------|----------------|------------------|----------------|------------------|----------------|------------------|
| 5 | 120 | 4,45 | 107 | 3,91 | 94 | 3,37 | 81 |
| 4,95 | 119 | 4,41 | 106 | 3,87 | 93 | 3,33 | 80 |
| 4,91 | 118 | 4,37 | 105 | 3,83 | 92 | 3,29 | 79 |
| 4,87 | 117 | 4,33 | 104 | 3,79 | 91 | 3,25 | 78 |
| 4,83 | 116 | 4,29 | 103 | 3,74 | 90 | 3,2 | 77 |
| 4,79 | 115 | 4,25 | 102 | 3,7 | 89 | 3,16 | 76 |
| 4,75 | 114 | 4,2 | 101 | 3,66 | 88 | 3,12 | 75 |
| 4,7 | 113 | 4,16 | 100 | 3,62 | 87 | 3,08 | 74 |
| 4,66 | 112 | 4,12 | 99 | 3,58 | 86 | 3,04 | 73 |
| 4,62 | 111 | 4,08 | 98 | 3,54 | 85 | 3 | 72 |
| 4,58 | 110 | 4,04 | 97 | 3,49 | 84 | <3 | Not enough |
| 4,54 | 109 | 3,99 | 96 | 3,45 | 83 | | |
| 4,5 | 108 | 3,95 | 95 | 3,41 | 82 | | |

Criteria for establishing the assessment on the traditional 4-point and ECTS scale after passing the exam:

| Points by the multi-point (200) scale | Grade by the 4-point scale (National assessment scale) | Score ECTS |
|---------------------------------------|--------------------------------------------------------|------------|
| 180-200 | 5 | A |
| 160-179 | 4 | B |
| 150-159 | | C |
| 130-149 | | D |
| 120-129 | 3 | E |
| 50-119 | | FX |
| 0-49 | | F |

The criteria for the evaluation.

During assessment of the assimilation of each topic for current educational activities of the applicant higher education grades are given on a national scale (traditional) scale with regard to the approved evaluation criteria:

- “*excellent*” (5)- student flawlessly learned the theoretical material of the topic, demonstrates deep and comprehensive knowledge of the relevant topics, the main provisions of scientific sources and recommended literature, to think logically and builds a response, freely use the acquired theoretical knowledge in the analysis of practical material, expresses his attitude to certain issues, demonstrates a high level of mastering of practical skills;
- “*good*” rating (4) - the student has well learned the theoretical material of the lesson has the basic aspects of primary sources and recommended literature, convincingly expounds it; possesses practical skills and expressed their concerns about certain problems, but it is assumed certain inaccuracies and errors in the logic of presentation of theoretical content or performing practical skills.
- “*satisfactory*” (3) - the student has basically mastered the theoretical knowledge training topics, versed in the primary sources and recommended literature, but unconvincing answers, confuses, additional issues are the student's uncertainty or lack of stable knowledge; answering questions of a practical nature, reveals inaccuracies in knowledge, does not know how to evaluate facts and phenomena linked with the future activity, allows for errors in the performance of practical skills;

- “unsatisfactory” (2) the student has not mastered the learning material of the topic, knows scientific facts, definitions, is almost oriented in the primary sources and recommended literature, no scientific thinking, practical skills are not formed.

Exhibited on the traditional scale are converted in points. The minimum number of points that need to recruit a student for current educational activity per semester for admission to the exam is 120 points.

11. METODICAL SUPPLY

1. Work program of the discipline.
2. Calendar-thematic plans of lectures and practical classes.
4. Examples of test tasks for classes.
5. Test tasks for the exam.

12. RECOMMENDED LITERATURE

Basic

1. Cappuccino G. Microbiology: A Laboratory Manual, Global Edition, 11th Edition / G.Cappuccino, Chad T. Welsh. - Pearson Higher Ed USA, 2017. – 560 p.
2. Medical Microbiology 27 E (Lange) / K. C. Carroll, S. Morse, T. Mietzner [et al.]. - McGraw-Hill Education, 2016. – 864 p.
3. Murray P.R. Medical Microbiology 8th Edition / P.R. Murray, K.S. Rosenthal, M.A. Pfaller. – Elsevier, 2016. - 848 p.

Additional

4. Engelkirk P.G. Burton's Microbiology for the Health Sciences / P.G. Engelkirk, J. Duben-Engelkirk, R. Fader. - Wolters Kluwer Health, 2015. – 488 p.
5. Hawley L. Microbiology and Immunology (Board Review Series) Sixth Edition / L. Hawley, R.J. Ziegler, B. L. Clarke. - Lippincott Williams & Wilkins, 2014. – 320 p.

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