

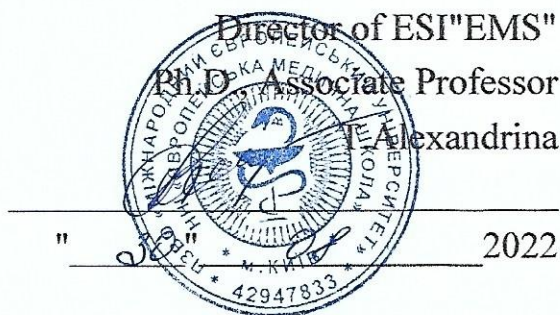
**INTERNATIONAL EUROPEAN UNIVERSITY
EDUCATIONAL AND SCIENTIFIC INSTITUTE
"EUROPEAN MEDICAL SCHOOL"**

APPROVED

Director of ESI"EMS"

Ph.D. Associate Professor

Alexandrina




**COURSE TRAINING PROGRAM
on
MICROBIOLOGY, VIROLOGY, IMMUNOLOGY**

Degree level	Master
Field of study	22 "Health care"
Specialty	222 "Medicine"

Kyiv - 2022

DEVELOPED AND SUBMITTED: Educational and Scientific Institute "European Medical School", Department of Fundamental and Medical and Preventive Disciplines.

Developed by: Kostynskyi G.B., manager Department of Fundamental and Medical Preventive Disciplines, Vergolyas M.R. Doctor of Medicine, Professor of the Department of Fundamental and Medical Preventive Disciplines, N.P. Rybalchenko, Candidate of Science, Associate Professor of the Department of Fundamental and Medical Preventive Disciplines.

Discussed and approved by the Department of Fundamental and Medical Preventive Disciplines №.1 from " 25 " 08 2022
Head of the department Kostynskyi G.B. 

Approved at the meeting of the Scientific Council of the ESI"EMS"
№ 1 of " 29 " 08 of 2022

Introduction

Study program of the academic discipline "Microbiology, virology and immunology" compiled in accordance with Standard of higher education of the second (master's) level of training for higher education holders of the "Master's" educational degree, field of knowledge 22 - "Health care", specialty - 222 "Medicine", educational qualification level "Master of Medicine".

Description of the academic discipline (abstract). The study of the discipline "Microbiology, Virology and Immunology" is based on knowledge main natural and scientific disciplines : medical biology, medical and biological physics, biological and bioorganic chemistry, human anatomy, histology, cytology and embryology, Latin language, history of medicine, philosophy and integrates with these disciplines.

Information volume of the academic discipline

Name of indicators	Field of knowledge, direction of training, educational and qualification level	Characteristics of the academic discipline	
		full-time education	
The number of credits is 8	Branch of knowledge 22 "HEALTH PROTECTION"	Normative (optional)	
	Field of study "Medicine"		
Sections - 2	Specialty: 222 "Medicine"	A year of training	
Substantial births - 14		2 and 3	
The total number of hours is 270		Semester	
		And V	V
	Lectures		
Weekly load: classrooms - 2	Education level: "Master of Medicine" qualifications of a professional "doctor"	20	20
		Practical	
		48	60
		Individual work	
		52	70
		type of control	
test	exam		

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

Interdisciplinary connections :

The study of the discipline "Microbiology, virology and immunology" lays the foundations for students to study general hygiene, epidemiology, pathological physiology, pathological anatomy, immunology and allergology, infectious diseases, internal diseases, surgical diseases and children's diseases and other clinical disciplines, which involves the integration of teaching with these disciplines and applying knowledge of microbiology, virology and immunology in the process of further education and professional activity. Also, the discipline lays the foundations of teaching

about the physiological role of microbes in the human body and the prevention of disruption of these functions in the process of medical interventions .

1. The purpose and tasks of the educational discipline

1.1. The purpose of studying the discipline stems from the goals of the educational and professional training program for graduates of a higher medical educational institution and is determined by the content of those systemic knowledge and skills that a specialist doctor must master. The knowledge that students receive from the academic discipline "Microbiology, virology and immunology" is basic for the block of disciplines that provide natural-scientific (PN block) and professional-practical (PP block) preparation

1.2. The main tasks of studying the academic discipline "Microbiology, virology and immunology" are:

- Interpret the biological properties of pathogenic and non-pathogenic microorganisms, viruses and patterns of their interaction with the macroorganism, the human population and the external environment.
- To determine the methods of microbiological and virological diagnostics, etiotropic therapy and specific prevention of infectious diseases.
- Explain the structure of the immune system of the human body.
- Interpret the main mechanisms of formation of the immune response of the human body.
- Determine the main types of pathological reaction of the immune system and connections with the emergence of the most common human diseases.

1.3 Competencies and learning outcomes, the formation of which contributes to the discipline (interrelationship with the normative content of the training of higher education applicants, formulated in terms of learning outcomes in the Standard of Higher Education).

According to the requirements of the Standard of Higher Education of Ukraine (second (master's) level of higher education, field of knowledge 22 "Health care", specialty 222 "Medicine"), the discipline ensures that students acquire the following competencies:

-integral: the ability to integrate knowledge and solve complex specialized tasks in broad and multidisciplinary contexts of a doctor's professional activity, to solve practical problems in new or unfamiliar environments in the presence of incomplete or limited information, taking into account the aspects of social and ethical responsibility in the field of health care .

- general and professional:

general competence (ZK)	
ZK 1.	Ability to abstract thinking, analysis and synthesis.
ZK 2.	Ability to learn and master modern knowledge.
ZK 3.	Ability to apply knowledge in practical situations.
ZK 4.	Knowledge and understanding of the subject area and understanding of professional activity
ZK 5.	Ability to adapt and act in a new situation
ZK 6.	Ability to make informed decisions
ZK 7.	Ability to work in a team
ZK 8.	Ability to interpersonal interaction
ZK 10.	Ability to use information and communication technologies
ZK 11.	Ability to search, process and analyze information from
ZK 12	Determination and persistence of delivered tasks and taken responsibilities
Professionals competence (FC)	
FC 1.	Ability to collect medical information about the patient and analyze clinical data

FC 2	Ability to determine the necessary list of laboratory and instrumental studies and evaluate their results
FC 3	Ability to establish a preliminary and clinical diagnosis of the disease
FC 6	Ability to determine the principles and nature of treatment and prevention of diseases
FC 7	Ability to diagnose emergency conditions
FC 11.	Ability to solve medical problems in new or unfamiliar environments in the presence of incomplete or limited information, taking into account aspects of social and ethical responsibility.
FC 17	The ability to assess the impact of the environment, socio-economic and biological determinants on the state of health of an individual, family, population.
FC 23	The ability to develop and implement scientific and applied projects in the field of health care.
FC 24	Adherence to ethical principles when working with patients and laboratory animals
FC 25	Adherence to professional and academic integrity, to be responsible for the reliability of the obtained scientific results
Software the results teaching (PRN)	
PRN 1.	Have thorough knowledge of the structure of professional activity. Be able to carry out professional activities that require updating and integration of knowledge. To be responsible for professional development, the ability for further professional training with a high level of autonomy
PRN 2.	Understanding and knowledge of basic and clinical biomedical sciences, on level sufficient for solving professional tasks in the field of health care
PRN 3	Specialized conceptual knowledge, which includes scientific achievements in the field of health care and is the basis for conducting research, critical understanding of problems in the field of medicine and related interdisciplinary problems.
PRN 4	Identify and identify leading clinical symptoms and syndromes (according to list 1); according to standard methods, using preliminary data of the patient's history, data of the patient's examination, knowledge about the person, his organs and systems, establish a preliminary clinical diagnosis of the disease (according to list 2). .
PRN 7	Assign and analyze additional (mandatory and optional) methods examination (laboratory, functional and/or instrumental) (according to list 4), patients with diseases of organs and systems of the body for carrying out differential diagnosis of diseases (according to list 2).
PRN 8	Determine the main clinical syndrome or what causes the severity of the condition of the victim/injured (according to list 3) by making a reasoned decision and assessing the person's condition under any circumstances (in the conditions of a health care institution, outside its borders) , including in conditions of emergency and hostilities, in field conditions, in conditions of lack of information and limited time.
PRN 9	Determine the nature and principles of treatment (conservative, operative) of patients with diseases (according to list 2), taking into account the patient's age, in the conditions of a health care institution, outside its borders and at the stages of medical evacuation , including in field conditions, on the basis of a preliminary clinical diagnosis, observing the relevant ethical and legal norms, by making a reasoned decision according to existing algorithms and standard schemes, in case of the need to expand the standard scheme, be able to substantiate personalized recommendations under the control of the head physician in the conditions of a medical institution
PRN 14	Determine tactics and provide emergency medical care in emergency situations (according to list 3) in limited time conditions in accordance with existing clinical protocols and standards of treatment

PRN 19	Plan and implement a system of anti-epidemic and preventive measures regarding the occurrence and spread of diseases among the population.
PRN 20	Analyze the epidemiological situation and carry out measures of mass and individual, general and local prevention of infectious diseases
PRN 21.	to search necessary information in professional literature and databases data others sources , analyze , evaluate and apply this one information .
PRN 23	Evaluate influence surrounding environment on health a person to assess the state of the disease population
PRN 24	Organize necessary level individual security (own and persons about whom cares) in case occurrence typical dangerous situations in the individual poly activities .
PRN 25	Clearly and unambiguously convey own knowledge , conclusions and arguments about protection problems health and related questions to specialists and non-specialists
PRN 28	Accept effective solutions to security problems health , evaluate are needed resources to consider social , economic and ethical consequences
PRN 29	Plan , organize and conduct events with specific prevention _ infectious diseases , including according to the National preventive calendar vaccinations , both mandatory and recommended . Manage vaccine residues , organize additional vaccine campaigns , in including immunoprophylaxis measures

Integrative final program learning outcomes, the formation of which is facilitated by the educational discipline:

- The ability to analyze the biological properties of pathogenic and non-pathogenic microorganisms, viruses and patterns of their interaction with the macroorganism, the human population and the external environment.
- The ability to interpret the main mechanisms of the formation of the immune response of the human body.
- The ability to determine the main types of pathological reaction of the immune system and connections with the emergence of the most common human diseases.
- Ability to determine methods of microbiological and virological diagnostics, etiotropic therapy and specific prevention of infectious diseases.

According to the standards of higher education, students must:

Know : In the conditions of a medical institution, applying a standard procedure, using knowledge about a person, his organs and systems, based on the results of laboratory and instrumental studies, evaluate information about the diagnosis (according to list 4):

- Serological reactions in infectious diseases;
- Microbiological research of biological fluids and secretions;
- Chemical, organoleptic, bacteriological research of food and water quality.

Be able to :

- Evaluate the results of laboratory and instrumental studies (according to the list 4) ;
- Anticipate the negative consequences of exposure to dangerous factors on the human body;
- Master modern methods of microbiological research with infectious diseases;
- Analyze the principles of obtaining vaccine preparations, 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 towards a living person, his body as an object of anatomical and clinical research.

2. Information volume of the academic discipline

270 hours, 9 ECTS credits are allocated to the study of the academic discipline.

The program of the discipline "**Microbiology, virology and immunology**" is structured into 2 sections, which include blocks of content sections .

270 hours (9 ECTS credits) are allocated to the study of the academic discipline .

Section I: 120 hours 4 , 0 ECTS loan .

Section II: 150 hours 5.0 ECTS loan .

Chapter 1. Morphology and physiology of microorganisms. Infection. Immunity.

Content sections:

1. Introduction to microbiology.
2. Morphology and structure of prokaryotes and parasitic unicellular eukaryotes. Staining of microorganisms. Microscopy.
3. Physiology of bacteria. Evolution and classification of microorganisms.
4. Genetics of microorganisms.
5. Microbiological bases of antimicrobial chemotherapy and antiseptics.
6. Infection.
7. The immune system of the body. Reactions of nonspecific protection against infectious agents.
8. Antigens, antibodies.
9. Reactions of immunity. Immunopathology.

Chapter 2. General and special virology.

Content sections:

10. General virology.
11. Special virology.
12. Pathogenic prokaryotes and eukaryotes.
13. Fundamentals of clinical microbiology.
14. Sanitary microbiology and virology.

3. The structure of the academic discipline

The name of meaningful sections and topics	Number of hours			
	Tha t's all	Including		
		l	p	s.r
SECTION I. Morphology and physiology of microorganisms. Infection. Immunity.				
<i>Content section 1, 2 . Introduction to microbiology . Morphology and structure of prokaryotes and parasitic unicellular eukaryotes. Staining of microorganisms. Microscopy.</i>				
Topic 1. Introduction to the discipline. Medical microbiology as a subject. History of microbiology as a science. Organization of work in the bacteriological, immunological and virological laboratory.	6	1	2	3
Topic 2. Morphology of bacteria.	6	1	2	3
Topic 3. Classification of microorganisms. Morphology and	6	1	2	3

ultrastructure of bacteria. Microscopy methods.				
Topic 4. Dyes and methods of manufacturing preparations.	5	-	2	3
Topic 5 . Simple methods of staining bacteria.	5	1	2	2
Topic 6. Structure of a bacterial cell.	5	1	2	2
Topic 7. Gram staining of bacteria and other complex staining methods.	5	1	2	2
Topic 8. Morphology of spirochetes, actinomycetes, fungi and pathogenic protozoa.	6	2	2	2
<i>Content section 3. Physiology of microorganisms (prokaryotes). Evolution and classification of microorganisms.</i>				
Topic 9. Physiology of bacteria.	5	2	2	1
Topic 10 . Nutrient media.	4	-	2	2
Topic 11. Sterilization and disinfection .	4	-	2	2
Topic 12. Growth and reproduction of microorganisms. Isolation of pure cultures of aerobes.	7	2	2	3
Topic 13. Growth and reproduction of microorganisms. Isolation of pure cultures of anaerobes. Identification of pure cultures of microorganisms.	4	-	2	2
Topic 14. Growth and reproduction of microorganisms. Isolation of pure cultures of anaerobes. Identification of pure cultures of microorganisms.	4	-	2	2
<i>Content section 4. Genetics of microorganisms. Content section 5. Microbiological basis of antimicrobial chemotherapy.</i>				
Topic 15. Genetics of bacteria. Variability	6	1	2	3
Topic 16. Chemotherapeutic drugs. Antibiotics	5	1	2	2
<i>Content section 6. Infection</i>				
Topic 17. Infectious process.	6	1	2	3
Topic 18. Modern methods of diagnosing infectious diseases.	5	1	2	2
<i>Content section 7. Immune system of the body. Reactions of non-specific protection of the body against microorganisms. Content section 8. Antigens. Antibodies. Content section 9. Immunity reactions. Immunopathology.</i>				
Topic 19. Organs of the human immune system	6	1	2	3
Topic 20. Factors of non-specific protection of the body.	5	1	2	2
Topic 21. Antigens. Antibodies.	7	2	2	3
Topic 22. Serological reactions.	4	-	2	2
Topic 23 Serological reactions with labels	5	-	2	3
Topic 24. Vaccines and immune serums. Final lesson from section I	4	-	2	2
<i>SECTION II. General and special virology. Pathogenic prokaryotes, eukaryotes, fungi.</i>				
<i>Content section 10. General virology</i>				
Topic 25. Morphology and ultrastructure of viruses.	5	1	2	2
Topic 26. Cultivation of viruses in the chicken embryo and the organism of laboratory animals.	6	1	2	3
Topic 27. Cultivation of viruses in cell cultures. Indication of viral reproduction. Serological reactions in virology	5	1	2	2
Topic 28. Genetics of viruses. Bacteriophages. Practical use.	5	1	2	2
<i>Content section 11. Special virology.</i>				
Topic 29. Orthomyxoviruses , paramyxoviruses .	5	1	2	2
Topic 30. Picornaviruses . Enteroviruses	4		2	2
Topic 31. Retroviruses . AIDS. RNA - genomic viruses: reoviruses , arenaviruses , rhabdoviruses . Herpesviruses , adenoviruses. Hepatitis viruses	5	1	2	2
Topic 32. Herpesviruses , adenoviruses. Hepatitis viruses	6	2	2	2
Topic 33. Vesicular stomatitis virus, togaviruses , filoviruses , coronaviruses...	4	-	2	2
Topic 34. Poxviruses , papovaviruses , parvoviruses .	4	-	2	2
Topic 35. Arboviruses. Oncogenic viruses. Prions	4	-	2	2

Content section 12. Pathogenic prokaryotes and eukaryotes.				
Topic 36. Staphylococci. Streptococci.	5	2	2	1
Topic 37. Meningococci . Gonococci	5	-	2	3
Topic 38. Salmonella. Typhoid. Paratyphus.	5	-	2	3
Topic 39. Salmonella gastroenteritis.	5	-	2	3
Topic 40. Shigeli . Dysentery .	5	-	2	3
Topic 41. Vibrios. Cholera. Corynebacteria.	6	2	2	2
Topic 42. Diphtheria. Bordetels . Whooping cough	4	-	2	2
Topic 43. Mycobacteria. Tuberculosis. Leprosy	4	-	2	2
Topic 44. Anaerobes. Botulism . Zoonthroposes .	4	-	2	2
Topic 45. Plague. Brucellosis.	4	-	2	2
Topic 46. Tularemia. Anthrax.	5	1	2	2
Topic 47. Rickettsia . Typhus. Whooping fever.	4	-	2	2
Topic 48. Chlamydia . Mycoplasmas	5	1	2	2
Topic 49. Spirochetes. Syphilis . Reverse typhus. Borreliosis . Leptospirosis	6	1	2	3
Topic 50. Pathogenic fungi. Microbiological diagnosis of mycoses. Protozoan infections.	4	1	2	1
Content section 13. Basics of clinical and environmental microbiology. Content section				
Topic 51. Clinical microbiology. Normal microflora of the body.	2	1	2	1
Topic 52. Dysbiosis . Correction	5	-	2	3
Topic 53. Intra- hospital infections. Iatrogenic infections.	6	1	2	3
Substantive chapter 14. Sanitary microbiology and virology				
Topic 54. Sanitary microbiology. Microflora of soil and food products. Microflora of water and air	7	2	2	3
EVERYTHING FROM THE DISCIPLINE	270	40	108	122

4. Lecture topics

No	Topics of lectures	Number of hours
	SECTION I. Morphology and physiology of microorganisms. Infection. Immunity.	
1.	Introduction to the discipline. Medical microbiology as a subject. History of microbiology as a science.	2
2.	Classification of microorganisms. Morphology and ultrastructure of bacteria.	2
3.	Physiology and biology of bacteria. Growth and reproduction of bacteria.	2
4.	Genetics and variability of microorganisms. Bacteriophages.	2
5.	The doctrine of infection. Pathogenicity, virulence. Biotechnology.	2
6.	Principles of antimicrobial therapy of diseases. Antibiotics	2
7 .	Immunology as a science. History of immunology. Factors of non-specific protection of the body	2
8 .	Types and forms of immunity. System of human immunological surveillance	2
9.	Antigens and antibodies..	2
10.	Immunoprophylaxis and immunotherapy	2
	SECTION II. General and special virology.	

11.	General virology. Morphology and ultrastructure of viruses. Classification, cultivation and detection of viruses.	2
12.	Ortho - and paramyxoviruses .. SARS-causing viruses. Corona viruses	2
thirteen.	Causative agents of naturally occurring (focal) viral infections.	2
14.	Togaviruses . Rhabdoviruses . The causative agent of rabies.	2
15.	Herpesviruses . Poxvirus (smallpox).	2
16.	Picornaviruses . Enteroviruses . HIV/AIDS. Viruses are the causative agents of hepatitis. Oncogenic viruses.	2
17.	Pathogenic cocci. Pathogenic enterobacteria . Agents of diphtheria and tuberculosis	2
18 .	The causative agents of particularly dangerous infections (plague, tularemia, brucellosis, anthrax). Pathogenic anaerobes. Spirochetes	2
19.	Ecology of microorganisms, normal microflora of the human body.	2
20.	D isbacteriosis . Basics of clinical and sanitary microbiology	2
Only hours		40

5. Seminar topics are not provided for in the program.

6. Topics of practical classes

No. z.p. _	TOPIC	Number of hours
SECTION I. Morphology and physiology of microorganisms. Infection. Immunity.		
1.	Introduction to the discipline. Organization of work in the bacteriological, immunological and virological laboratory.	2
2.	Morphology of bacteria.	2
3.	Microscopy methods.	2
4.	Dyes and methods of manufacturing preparations.	2
5.	Simple methods of staining bacteria.	
6.	The structure of a bacterial cell.	2
7.	Gram staining of bacteria and other complex staining methods.	2
8.	Morphology of spirochetes, actinomycetes, fungi and pathogenic protozoa.	2
9.	Physiology of bacteria.	2
10.	Nutrient media.	
11.	Sterilization and disinfection .	2
12.	Growth and reproduction of microorganisms. Isolation of pure cultures of aerobes.	2
13.	Growth and reproduction of microorganisms. Isolation of pure cultures of anaerobes. Identification of pure cultures of microorganisms.	2
14.	Growth and reproduction of microorganisms. Isolation of pure cultures of anaerobes.	2
15.	Bacterial genetics. Variability.	2
16.	Chemotherapeutic drugs. Antibiotics	2
17.	Infectious process.	2
18.	Modern methods of diagnosis of infectious diseases.	2

19.	Organs of the human immune system.	2
20.	Factors of non-specific protection of the body.	2
21.	Antigens. Antibodies.	2
22.	Serological reactions.	2
23.	Serological reactions with labels	2
24.	Vaccines and immune sera. Final lesson from section I	2
	<u>SECTION II. General and special virology. Pathogenic prokaryotes , eukaryotes , fungi .</u>	
25.	Morphology and ultrastructure of viruses.	2
26.	Cultivation of viruses in the chicken embryo and the body of laboratory animals.	2
27.	Cultivation of viruses in cell cultures. Indication of viral reproduction. Serological reactions in virology	2
28.	Genetics of viruses. Bacteriophages. Practical use.	2
29.	Orthomyxoviruses , paramyxoviruses .	2
30.	Picornaviruses . Enteroviruses	
31.	Retroviruses . AIDS. RNA - genomic viruses: reoviruses , arenaviruses , rhabdoviruses .	2
32.	Herpesviruses , adenoviruses. Hepatitis viruses	2
33.	Vesicular stomatitis virus, togaviruses , filoviruses , coronaviruses.	2
34.	Poxviruses , papovaviruses , parvoviruses	2
35.	Arboviruses. Oncogenic viruses. Prions	2
36.	Staphylococci. Streptococci.	2
37.	Meningococci . Gonococci	2
38.	Salmonella. Typhoid. Paratyphus.	2
39.	Salmonella gastroenteritis.	2
40.	Shigeli . Dysentery .	2
41.	Vibrios. Cholera. Corynebacteria.	2
42.	Diphtheria. Bordetels . Whooping cough	2
43.	Mycobacteria. Tuberculosis. Leprosy	2
44.	Anaerobes. Botulism . Zooanthroponoses .	2
45.	Plague. Brucellosis.	2
46.	Tularemia. Anthrax.	2
47.	Rickettsia . Typhus. Whooping fever.	2
48.	Chlamydia . Mycoplasmas	2
49.	Spirochetes Syphilis . Reverse typhus . Borreliosis . Leptospirosis	2
50.	Pathogenic fungi. Microbiological diagnosis of mycoses. Protozoan infections.	2
51.	Clinical microbiology. Normal microflora of the body.	2
52.	Dysbiosis . Correction.	2
53.	Intra- hospital infections. Iatrogenic infections	2
54.	Sanitary microbiology. Microflora of soil and food products. Microflora of water and air. Sanitary virology	2
	Total:	108

7. The topic of the laboratory is not provided by the program.

8. Independent work

No	Topic	Number hours
SECTION I. Morphology and physiology of microorganisms. Infection. Immunity.		
<i>Substantive chapters 1 and 2. "Introduction to microbiology . Morphology and structure of prokaryotes and parasitic unicellular eukaryotes. Staining of microorganisms. Microscopy.</i>		
1.	The main features and trends in the development of modern microbiology.	1
2.	Contribution of domestic scientists to the development of microbiology in Ukraine.	1
3.	Dependence of the results of staining microorganisms on their properties.	2
4.	Theories explaining the Gram staining mechanism of various microorganisms.	2
5.	Methods of identifying structural elements of bacteria: spores, capsules, flagella, inclusions, etc.	2
6.	Methods of studying the morphology of fungi and actinomycetes.	2
Content section 3. Physiology of microorganisms (prokaryotes). Evolution and classification of microorganisms.		
7.	Modern nutrient media for growing bacteria.	2
8.	The test is a system for determining the enzymatic activity of microorganisms.	2
9.	Origin and evolution of microorganisms. Basic principles of systematics of microorganisms.	2
10.	Modern classification of prokaryotes. Growth and method of reproduction of bacteria, phases of reproduction of bacterial culture in stationary conditions.	2
11.	Criteria for the identification of microorganisms. Classification of microorganisms, main taxa. Characteristics of the species.	2
Content section 4. Genetics of microorganisms.		
Content section 5. Microbiological basis of antimicrobial chemotherapy.		
12.	Genetics of microorganisms.	2
thirteen.	Modern test systems for determining the sensitivity of microbes to antibiotics.	2
Content section 6. Infection.		
Content section 7. Immune system of the body. Reactions of non-specific protection of the body against microorganisms.		
14.	The doctrine of infection. The role of microorganism, macroorganism and external environment in the infectious process.	2
15.	Characteristics of cell -tissue, physiological and humoral factors of non-specific protection.	2
Content section 8. Antigens. Antibodies.		
Content section 9. Immunity reactions. Immunopathology.		
16.	The value of the complement system in immune protection, ways of complement activation.	2
17.	Antigenic structure of bacteria. Autoantigens .	2
18.	Classes and structure of immunoglobulins . Autoantibodies . Monoclonal antibodies, their production and use in medical practice.	2

19.	Hypersensitivity of immediate and delayed type, their mechanisms, differences. Practical meaning.	3
20.	Immunological tolerance, causes of its occurrence.	3
21.	Three -cell system of immune response cooperation. The role of individual cells of the immune system, their interaction. Interleukins .	3
22.	Immunological memory, its mechanism.	3
23.	Immunodeficiency states, autoimmune processes. Comprehensive assessment of the body's immune status.	3
24	Preparation for the final control of learning of section I	3
SECTION II. General and special virology . Environmental microbiology.		
<i>Content section 10. General virology.</i>		
25.	The principle and essence of the polymerase chain reaction.	3
26.	The history of the discovery and the main stages of the development of virology. Contribution of domestic scientists. Methods of studying viruses, their assessment.	3
27.	Modern views on the nature and origin of viruses. The place of viruses in the living system.	3
28.	Principles of virus classification and their assessment.	3
29.	Bacteriophages, morphology and structure. Methods of qualitative and quantitative determination of bacteriophages.	3
30.	Non-specific factors of protection of the macroorganism against viral agents, their characteristics. Interferons, mechanism of action, interferonogens . Virus inhibitors.	3
<i>Content section 11. Special virology.</i>		
31.	Prospective directions for obtaining effective anti-influenza vaccines.	3
32.	Family Paramyxoviruses – viruses of parainfluenza, measles, epidemic parotitis, respiratory syncytial virus.	3
33.	Family of rhabdoviruses , properties of viruses. Specific prevention of rabies.	3
34.	General characteristics of the ecological group of arboviruses.	3
35.	Genus rubiviruses . Rubella virus.	3
36.	Smallpox virus	3
37.	Problems and prospects of obtaining vaccine preparations for the prevention of hepatitis. Modern vaccines.	3
38.	Oncogenic viruses, classification. Virogenetic theory of the occurrence of tumors L.O. Silber . Mechanisms of viral carcinogenesis.	2
39.	Prions , properties. Prion diseases.	2
40.	Preparation for the final control of learning of section II	2
<i>Content section 12. Pathogenic prokaryotes and eukaryotes.</i>		
41.	Scarlatinous streptococcus. Streptococcus pneumoniae. Enterococci. Anaerobic staphylococci and streptococci.	2
42.	General characteristics of other representatives of the Neisseria family: genera Moraxella, Acinetobacter, Kindella, their role in human pathology.	2
43.	Salmonella. General characteristics. Classification of Salmonella according to Kaufman and White.	2
44.	Comparative properties of pathogenic protozoa. The causative agent of amoebic dysentery.	2

45.	Parahemolytic vibrios, properties. Role in human pathology	2
46.	Brodetels whooping cough Haemophilus influenzae. Legionella	2
47.	Non-proliferative Gram-negative anaerobic bacteria of the genera: Bacteroidetes, Fusobacteria. Anaerobic cocci of the genera Peptococcus and Peptostreptococcus. Anaerobic bacteria of the genus Veylonela.	2
48.	The role of domestic scientists in the preparation of drugs for the specific prevention of zoonotic infections.	2
49.	Comparative properties of rickettsiae, mycoplasmas and viruses.	2
50.	General characteristics and classification of tortuous forms of microorganisms. Pathogenic spiracles. Campylobacter and Helicobacter .	2
51.	Pathogenic fungi and actinomycetes (causing agents of candidiasis , dermatomycosis , actinomycosis , their characteristics).	2
<i>Content section 13. Basics of clinical and environmental microbiology</i>		
52.	Criteria of the etiological role of opportunistic microorganisms isolated from a pathogenic focus from a patient in the clinic."	2
53.	Principles of diagnosis and treatment of dysbiosis .	2
<i>Content section 14. Sanitary microbiology and virology</i>		
54.	Sanitary, virological and bacteriological criteria for the assessment of water bodies, soil and air of closed premises.	2
Only hours		122

9. Individual tasks are not included in the program

1 0 Teaching methods

According to the sources of knowledge, teaching methods are used: verbal - story, explanation, lecture, instruction; visual - demonstration, illustration; practical - practical work, problem solving. According to the nature of the logic of knowledge, methods are used: analytical, synthetic, analytical-synthetic, inductive, deductive. According to the level of independent mental activity, the following methods are used: problem-based, searching, research.

1. Verbal methods: lecture, conversation;
2. Visual methods: illustration, demonstration
3. Practical methods: performing practical work and solving situational tasks to develop skills and abilities;
4. Students' independent work on understanding and assimilation of new material
5. Use of control and educational computer programs
6. Innovative teaching methods: business game, case method.

The types of training according to the curriculum are: lectures; practical training; independent work of students.

1 1 . Control methods

Current control is carried out on the basis of control theoretical knowledge, practical skills and abilities.

Forms of current control are: *in the* dream survey (frontal, individual, combined), interview; practical verification of professional skills (conducted based on the results of practical work at the end of the class); test control ("open" and "closed" test tasks).

Current control is mandatory. During the evaluation of mastering of each topic from all disciplines of the curriculum for the current educational activity, the student is given grades on a 4-point (traditional scale) taking into account the approved evaluation criteria for the discipline. All types of work provided by the curriculum are taken into account. The student must receive a grade in each topic. The teacher conducts a survey of each student in the group at each lesson and assigns a grade in the journal of attendance and student performance according to the traditional scale ("5", "4", "3", "2").

When evaluating the student's current educational activity, 20% of the grade is the student's independent work, which takes into account the knowledge of the topic of independent study and the performance of work in the notebook.

1 2 . The form of final control of study success .

The final control of the discipline is carried out on the basis of theoretical control knowledge, practical skills and abilities.

Assessment is a form of final control, which consists in assessing the student's learning of the learning material based solely on the results of his performance of certain types of work in practical, seminar or laboratory classes. Semester assessment of subjects is carried out after the end of its study, before the beginning of the examination session.

An exam (differential assessment) is a form of final control of a student's assimilation of theoretical and practical material from an educational discipline.

1 3 . Scheme of calculation and distribution of points received by students.

The maximum number of points for a discipline is 200 points. The ratio between the results of the evaluation of the current educational activity and the final control of knowledge is 60% and 40%.

The first semester of studying the discipline ends with a test.

The maximum number of points that a student can score for the current educational activity while studying the discipline is 200 points, *the minimum number of points* - the minimum number of points - is 120 points.

The calculation of the number of points is carried out on the basis of the grades received by the student on a 4-point (national) scale during the study of the discipline, by calculating the arithmetic mean, rounded to two decimal places.

The student receives a credit in the last lesson of the discipline based on the results of the current assessment.

Only those students who do not have academic debt and whose average score for the current academic activity in the academic discipline is at least 3.00 are admitted to the credit.

The average grade for the current activity is converted into points on a 200-point scale, according to the conversion table (Table 1).

Table 1.

Recalculation of the average grade for the current activity into a multi-point scale (for disciplines ending with 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	4.44	178	3.92	157	3.39	136
4.94	198	4.42	177	3.89	156	3.37	135
4.92	197	4.39	176	3.87	155	3.34	134
4.89	196	4.37	175	3.84	154	3.32	133
4.87	195	4.34	174	3.82	153	3.29	132
4.84	194	4.32	173	3.79	152	3.27	131
4.82	193	4.29	172	3.77	151	3.24	130
4.79	192	4.27	171	3.74	150	3.22	129
4.77	191	4.24	170	3.72	149	3.19	128
4.74	190	4.22	169	3.69	148	3.17	127
4.72	189	4.19	168	3.67	147	3.14	126
4.69	188	4.17	167	3.64	146	3.12	125
4.67	187	4.14	166	3.62	145	3.09	124
4.64	186	4.12	165	3.59	144	3.07	123
4.62	185	4.09	164	3.57	143	3.04	122
4.59	184	4.07	163	3.54	142	3.02	121
4.57	183	4.04	162	3.52	141	3	120
4.54	182	4.02	161	3.49	140	< 3	70-119 (refolding)
4.52	181	4.00	160	3.47	139		
4.49	180	3.97	159	3.44	138		

The learning result is also evaluated on a two-point scale (passed/failed).

Table 2

The scale of transferring points to the national system

According to the national system	On a 200-point scale
counted	from 120 to 200 points
not counted	less than 119 points

Students' independent work, which is provided for by the topic of the lesson along with classroom work, is evaluated during the current control of the topic in the corresponding lesson.

The second semester (the last semester of studying the discipline) ends with a final control in the form of an exam.

Only those students who do not have academic debt (all missed classes have been completed) and whose average score for the current educational activity in the academic discipline is at least "3" are admitted to the exam.

The maximum number of points that a student can score for the current educational activity for admission to the exam is 120 points and is defined as the sum of the arithmetic average of all grades received in the semester.

The minimum number of points that a student must score for the current educational activity for admission to the exam is 72 points. Recalculation of the average grade for the current academic performance (on a 120-point scale) in the table. 3.

Table 3.

Recalculation of the average grade for the current academic performance in a multi-point scale for disciplines ending with an exam

4-point scale	200-point scale	4-point scale	200-point scale	4-point scale	200-point scale
5	120	4.29	103	3.58	86
4.96	119	4.25	102	3.54	85
4.92	118	4.21	101	3.50	84
4.87	117	4.17	100	3.46	83
4.83	116	4.12	99	3.42	82
4.79	115	4.08	98	3.37	81
4.75	114	4.04	97	3.33	80
4.71	113	4.00	96	3.29	79
4.67	112	3.96	95	3.25	78
4.62	111	3.92	94	3.21	77
4.58	110	3.87	93	3.17	76
4.54	109	3.83	92	3.12	75
4.50	108	3.79	91	3.08	74
4.46	107	3.75	90	3.04	73
4.42	106	3.71	89	3	72
4.37	105	3.67	88	Less than 3	Not enough
4.33	104	3.62	87		

The maximum number of points that a student can score when taking the exam is 80 (the minimum number is at least 50).

Discipline assessment is defined comprehensively as the sum of points for the current educational activity and points for the exam.

From the allocated 120 points for the current educational activity, 4 to 12 additional points are allocated for the assessment of individual independent work of higher education applicants, according to the work curriculum. Encouragement points are added to the final grade for the discipline at the end of its study.

Points with disciplines for students, which successfully completed the program are converted into the national scale and ECTS system (Table 4, 5).

Table 4.

Discipline points	Evaluation on a 4-point scale
From 180 to 200 points	5
From 150 to 179 points	4
From 149 points to the minimum number of points that the student must score	3
Below the minimum number of points that the student must score	2

Table 5

Scale assessment: national and ECTS

Sum points	Rating ECTS	Rating by national scale	
		for exam, difzalik	for offset
180-200	A	perfectly	counted
160-179	B	okay	
150-159	C	satisfactorily	
130-149	D		
120-129	E		
50-119	FX	unsatisfactorily with the possibility of refolding	not counted with possibility rearrangement
0-49	F	unsatisfactorily with mandatory repeated studying the discipline	not counted with mandatory repeated study disciplines

1 4 . Methodical support

1. Working curriculum of the discipline;
2. Plans of lectures, practical classes and independent work of students;
3. Abstracts of lectures on the discipline;
4. Methodical instructions for practical classes for students;
5. Methodical materials that ensure independent work of students;
6. Test and control tasks for practical classes;
7. List of exam questions

1 5 . Recommended Books**Main:**

1. Medical microbiology, virology and immunology. 3rd Edition, Revised and Augmented. Shirobokov V.P. - Vinnytsia: "New Book", 2021 - 920 p.
2. Microbiology with the basics of immunology: a textbook /V.V. Danileichenko , Y.M. Fedechko , O.P. Korniychuk, I.I Soloninko. 3rd edition - Kyiv: Medicine, 2020. - 376 p.

Additional:

1. Practical microbiology: study guide / S.I. Klimniuk , I.O. Sytnyk, V.P. Shirobokov; in general _ ed.: V.P. Shirobokov, S.I. Klimniuk . – Vinnytsia: Nova Kniga, 2018. – 576 p.
2. Shirobokov V.P., Klimnyuk S.I. Microbiology, virology and immunology in questions and answers: teaching . help _ / [Shyrobokov V.P. Klimniuk S.I., Korniychuk O.P. etc.]. – Ternopil: TDMU, 2019. – 564 v. Danileychenko V.V.
3. Microbiology with the basics of immunology: a textbook for medical universities / V. V. Danileichenko , Y. M. Fedechko , O. P. Korniychuk. - 2nd ed., revision. and additional _ - Kyiv: Medicine, 2009. - 391 p.
4. Medical microbiology. Handbook of Microbial Infections: Pathogenesis, Immunity, Laboratory Diagnosis, and Control: 19th Edition: In 2 Volumes. Volume 2/ Michael R. Barer , Will Irving , Andrew Swan , Nelyun Perera - 2021 - 386 cBioorganic Chemistry : textbook / Yu . Gubskiy . - 2nd ed . – Vinnitsa: Nova Knyha , 2019. - 224 p.

5 . V.P. Shirobokov. Microbes in biochemical processes , evolution biosphere and existence humanity . /V.P. Shirobokov, D.S. Yankovsky , G.S. Diamond . - K: FOP Veres O.I., 2014. - 464 p.

17. Information resources

1. World Health Organization <http://www.who.int/en/>
2. Microbiology and immunology online <http://www.microbiologybook.org/>
3. On-line microbiology notes <http://www.microbiologyinfo.com/>
4. Centers for disease control and prevention www.cdc.gov