

EUROPEAN MEDICAL UNIVERSITY

SYLLABUS OF THE EDUCATIONAL DISCIPLINE "MICROBIOLOGY, VIROLOGY AND IMMUNOLOGY"

Cycle of Higher Education:	second cycle of higher education (Master's degree)
Field of Study:	22 «Healthcare»
Specialty:	222 «Medicine»
Educational qualification:	Master of Medicine
Professional qualification:	doctor

1. Name, Code of the discipline and number of credits

Syllabus of the educational discipline "MICROBIOLOGY, VIROLOGY AND IMMUNOLOGY"

Cycle of Higher Education: second cycle of higher education (Master's degree)

Field of Study: 22 «Healthcare»

Specialty: 222 «Medicine»

Educational qualification: Master of Medicine

Professional qualification: doctor

Course and Semester: 2, 3 courses and 4, 5 semesters

Number of credits ECTS (number of hours): 8 credits ECTS (240 hours).

Distribution by types of trainings and hours of study – Lectures 18 hours, Practical lessons – 111 hours, Independent work – 111 hours.

2. Time and place of educational discipline

Semester: 4, 5

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3. Prerequisites and Postrequisites of educational discipline

Prerequisites: Microbiology, virology and immunology as an educational discipline is based on the knowledge acquired by students from such disciplines as medical biology, medical and biological physics and informatics, biological chemistry, histology, cytology and embryology, human anatomy and physiology and is integrated with these disciplines.

Lays the foundations for students to study general hygiene, epidemiology, pathological physiology, pathological anatomy, immunology and allergology, infectious diseases and other clinical disciplines, which involves the integration of teaching with these disciplines and the application of knowledge of microbiology, virology and immunology in the process of further education and in the professional activity.

Postrequisites: Propaedeutics of internal medicine, Internal medicine, Surgery, Social medicine, public health and the basics of evidence-based medicine, Midwifery, Emergency and urgent medical care, General medical training.

4. Characteristic of the educational discipline

4.1. The purpose of teaching the educational discipline "Microbiology, virology and immunology" is to ensure the knowledge of morphology, physiology, ecology, genetics, taxonomy of microorganisms, specific mechanisms of protection of the human body against pathogenic microorganisms, as well as to form the necessary skills in the future practical activity of the specialist. and skills.

4.2. The task of studying the discipline

The main tasks of the study of the discipline "Microbiology, virology and immunology" are to lay the foundation for students to study theoretical knowledge, mastering practical skills and abilities in microbiology, virology and immunology, which involves the integration of teaching with departments of a clinical profile and the formation of the ability to apply knowledge and skills in

professional activities. Formation of a future specialist capable of solving clinical problems using acquired knowledge and skills in the discipline, laying the foundations of a healthy lifestyle.

4.3. Appointment of the discipline

Competencies

General competencies (GC):

GC 1	Ability to think abstractly, analyses and synthesize.
GC 2	Ability to learn and master modern knowledge.
GC 3	Ability to apply knowledge in practical situations.
GC 4	Knowledge and understanding of the subject area and understanding of professional activities.
GC 6	Ability to make justified decisions.
GC 10	Ability to use information and communication technologies.
GC 11	Ability to search, process and analyses information from various sources.
GC 12	Certainty and perseverance in relation to the tasks set and responsibilities assumed.

Special (professional, subject) competencies (SC):

SC 2	Ability to determine the necessary list of laboratory and instrumental studies and evaluate their results.
SC 14	Ability to plan and carry out preventive and anti-epidemic measures against infectious diseases.
SC 17	Ability to assess the impact of the environment, socio-economic and biological determinants on health of an individual, family, and population.
SC 23	Ability to develop and implement scientific and applied projects in the healthcare sector.
SC 25	Compliance with professional and academic integrity, being responsible for reliability of the obtained scientific results.

Program learning outcomes (PLO):

PLO 1	Have a thorough knowledge of the structure of professional activity. Be able to carry out professional activities that require updating and integrating knowledge. Be responsible for professional development, the ability to further professional training with a high level of autonomy.
PLO 2	Understanding and knowledge of fundamental and clinical biomedical sciences at a level sufficient to solve professional problems in the field of healthcare.
PLO 3	Specialized conceptual knowledge that includes scientific achievements in the field of healthcare and is the basis for conducting research, critical understanding of problems in the field of Medicine and related interdisciplinary problems.
PLO 7	Prescribing and analyzing additional (mandatory and optional) examination methods (laboratory, functional and/or instrumental) (according to list 4), patients with diseases of organs and body systems for differential diagnosis of diseases (according to list 2).
PLO 19	Planning and implementing a system of anti-epidemic and preventive measures for the occurrence and spread of diseases among the population.

PLO 21	Searching for the necessary information in professional literature and databases of other sources, analyzing, evaluating and applying this information.
PLO 23	Assessing impact of the environment on human health to assess the state of morbidity in the population.
PLO 29	Planning, organizing and carrying out measures for specific prevention of infectious diseases, including according to the national schedule of preventive vaccinations, both mandatory and recommended. Managing vaccine residues, organizing additional vaccination including immunoprophylaxis measures.

4.4 Content of the discipline

Lectures plan (L)

№	THEMES	hours
1.	The value of medical microbiology in the practical activity of a doctor. History of microbiology. Original methods of microbiological research. Morphology of microorganisms. Evolution and classification of microorganisms. Structure and chemical composition of a bacterial cell.	2
2.	Physiology of microorganisms. Growth and reproduction of microorganisms.	2
3.	General virology	2
4.	Genetics of bacteria and viruses. Basics of biotechnology and genetic engineering. Chemotherapeutic drugs. Antibiotics.	2
5.	Microflora of the environment. Microbiome of the human body. History of the development of immunology. The doctrine of infection. Non-specific protective factors.	2
6.	Antigens, properties. Antigens of microorganisms. Antibodies, structure. Classes of immunoglobulins. Immunoprophylaxis and immunotherapy.	2
7.	The body's immune system. Patterns of the immune response. Interaction of cells of the immune system in the immune response. Immunopathology.	2
8.	The causative agents of diphtheria, tuberculosis and whooping cough.	2
9.	Causative agents of anaerobic infections. Tortuous forms of pathogenic microorganisms.	2
In total		18

Practical lessons plan (PL)

№	THEMES	hours
2nd year, 4th semester		
1	Organization of bacteriological laboratory. microorganisms Microscopy. Dyes and simple dyeing methods.	3
2	Morphology and structure of bacteria. Gram staining of bacteria.	3

3	Morphology of spirochetes, actinomycetes, fungi. Complex painting methods.	3
4	Physiology of microorganisms. Isolation of pure cultures of aerobic and anaerobic bacteria.	3
5	Cultivation and indication of viruses. Bacteriophages.	3
6	Microbiological basics of sterilization and disinfection, concepts of asepsis and antiseptics.	3
7	Chemotherapeutic drugs. Antibiotics.	3
8	Microbiome of the human body. Dysbiosis. Probiotics.	3
9	Sanitary virology and bacteriology.	3
10	Final control "General microbiology".	3
11	Factors of non-specific protection of the body against microorganisms.	3
12	Antigens and antibodies.	3
13	Serological reactions: RA, RPGA, RIF, ELISA, immunoblotting.	3
14	The body's immune system. Form of immune response.	3
15	Serological reactions: RP, RSK, RN.	3
16	Genodiagnostics, PCR.	3
17	Immune status of the body. Vaccines and immune serums.	3
18	Final control "Infection and immunity".	3
Total for the 2nd year, 4th semester		54
3rd year, 5th semester		
1	Staphylococci and streptococci. Microbiological diagnosis of diseases caused by staphylococci and streptococci. Meningococci and gonococci. Microbiological diagnosis of diseases caused by meningococci and gonococci.	3
2	Escherichia. Microbiological diagnosis of diseases caused by Escherichia coli. Shigella. Microbiological diagnosis of dysentery. Salmonella. Microbiological diagnosis of typhoid and paratyphoid diseases and salmonellosis gastroenteritis.	3
3	Microbiological diagnostics of food toxic infections and intoxications. Vibrios. Microbiological diagnosis of cholera. Helicobacter pylori, microbiological diagnosis of helicobacteriosis	3
4	Corynebacteria. Microbiological diagnosis of diphtheria. Bordetella, microbiological diagnosis of whooping cough.	3
5	Mycobacteria. Microbiological diagnosis of tuberculosis and mycobacteria.	3
6	Causative agents of anaerobic infections. Microbiological diagnosis of gas gangrene, tetanus, botulism.	3

7	Spirochetes Microbiological diagnosis of syphilis, leptospirosis, typhus, Lyme disease.	3
8	Rickettsia, chlamydia, mycoplasma. Microbiological diagnosis of rickettsiosis, chlamydia and mycoplasmosis.	3
9	Pathogens diagnosis of zoonotic infections: plague, anthrax, brucellosis, tularemia.	3
10	Pathogenic fungi and actinomycetes. Microbiological diagnosis of mycoses and actinomycoses.	3
11	The causative agents of protozoan infections. Tropical medicine.	3
12	Content control "Pathogenic prokaryotes and eukaryotes".	3
13	Orthomyxoviruses. Laboratory diagnosis of influenza. Paramyxoviruses. Laboratory diagnosis of measles. Coronaviruses. Covid 19.	3
14	Herpesviruses, adenoviruses. Laboratory diagnosis of herpes and adenovirus infections.	3
15	Picornaviruses. Laboratory diagnostics of enterovirus infections. Rhabdoviruses. Laboratory diagnosis of rabies.	3
16	The causative agents of viral hepatitis. Laboratory diagnosis of viral hepatitis.	3
17	Retroviruses HIV. Laboratory diagnosis of HIV infection."	3
18	Clinical microbiology. Pathogens of opportunistic infections.	2
19	Biosafety. Bioprotection.	2
20	Summary control	2
In total, for the 3rd year, 5th semester		57
In total		111

Independent work topics (IW)

№	THEMES	hours
1.	Preparation for practical classes - theoretical preparation and development of practical skills, filling in cards for independent work with tests	8
2.	Preparation for content-based module tests – study of theoretical material based on the textbook and additional information sources, work with test databases (4 hours for each lesson).	8
3.	Independent study of topics that are not part of the classroom lesson plan:	8
4.	Stages of development of microbiology	8
5.	Genetics of viruses.	8
6.	Morphology and structure of protozoa	8

7.	Identification of pure cultures of microorganisms	8
8.	The main stages of the development of immunology.	8
9.	Anaerobic non-clostridial bacteria	8
10.	Gram-negative non-fermenting bacteria	8
11.	Other pathogenic bacteria	8
12.	Ecological group of arboviruses	8
13.	Other RNA-genomic viruses	8
14.	Poxviruses, papovaviruses, parvoviruses	7
In total		111

4.5 Credit structure of “MICROBIOLOGY, VIROLOGY AND IMMUNOLOGY” discipline.

Discipline	Credit ECTS	Number of hours				
		In total	Aud	Lectur es	Seminary	inde pend ent
2 course 4th semester						
«MICROBIOLOGY, VIROLOGY AND IMMUNOLOGY»	4	120	72	18	54	48
3 course 5th semester						
«MICROBIOLOGY, VIROLOGY AND IMMUNOLOGY»	4	120	57	-	57	63

The topics of the lecture course in the 1st year reveal the problematic issues of the relevant sections of " MICROBIOLOGY, VIROLOGY AND IMMUNOLOGY ".

Practical skills:

1. Record and evaluate the results of the hemagglutination reaction (HGA) to determine the presence of the parainfluenza virus in an infected chicken embryo. Conclude.
2. Record the results of phage identification of the blood culture isolated from a patient with suspected typhoid fever. Conclude.
3. Record the results of the titration of intestinal bacteriophage in the water of an open reservoir according to the Apelman method.
4. To record and evaluate the results of the hemagglutination inhibition reaction (HGA) performed with paired sera of the examinee and standard parotitis diagnostics. Conclude.

5. To evaluate the results of enzyme-linked immunosorbent assay (ELISA) performed with the sera of the examinees in order to detect antibodies to HIV antigens (anti-gr 120). Conclude.
6. To record and evaluate the results of the neutralization reaction (PH) - a colored sample prepared with paired sera of the examinee and a diagnosticum - a strain of the 1st poliomyelitis virus. Conclude.
7. Record and evaluate the results of the complement binding reaction (CRT) performed with paired sera of the examinee and diagnosticum - a standard specific adenoviral antigen. Conclude.
8. To record and evaluate the results of the neutralization reaction (PH) - color sample, for the purpose of seroidentification of the selected strain of the poliomyelitis virus. Conclude.
9. Record and evaluate the results of the hemagglutination inhibition reaction (HAI) performed with paired sera of the subject and a standard viral diagnostic (reference strain of H1N1 influenza virus). Conclude.
10. To record and evaluate the results of the hemagglutination inhibition reaction (HAI) performed for the purpose of seroidentification of the selected influenza virus strain. Conclude.
11. To evaluate the results of enzyme-linked immunosorbent assay (ELISA) of sera of pregnant women in order to detect IgM to herpes simplex virus antigens. Conclude.
12. To evaluate the results of an enzyme-linked immunosorbent assay (ELISA) performed with the examinees' sera for the purpose of detecting IgG to HSV-1 antigens. Conclude.
13. To evaluate the results of enzyme-linked immunosorbent assay (ELISA) performed with patient sera for the purpose of detecting Ig M to antigens of the hepatitis A virus.
14. Microscopy the preparation, determine the staining method, morphology and tinctorial properties of bacteria. Preparations for microscopy: 1) staphylococcus; 2) streptococcus; 3) monobacteria; 4) capsular bacteria; 5) spores for Ozheshko; 6) spores according to Peshkov; 7) spores according to Gram; 8) yeast-like fungi; 9) incomplete phagocytosis of diplococci.
15. Prepare a preparation from a culture of bacteria grown on a dense nutrient medium, stain it according to Gram-Blue. Microscopy, determine morphology and tinctorial properties.
16. Prepare a preparation from a culture of bacteria grown on a dense nutrient medium, color it using a simple method. Microscopy, determine morphology.
17. Prepare a preparation from the patient's sputum, color it according to Tsel-Nielsen, make a microscope, determine the morphology.
18. Describe the cultural properties of bacteria under the conditions of their growth on a dense nutrient medium.
19. The principle composition and mechanism of action of the Endo medium. Practical implementation.
20. The principle composition and mechanism of action of Levin's environment. Practical implementation.
21. Principle composition and mechanism of action of Ploskirev medium. Practical implementation.

22. Practical application of Kitta-Tarozzi medium, principle composition and mechanism of action. Practical implementation.
23. Record the biochemical properties of the selected pure culture of bacteria. Conclude.
24. To determine the sensitivity of the staphylococcus culture to antibiotics by the method of diagnostic disks. Take stock, make a conclusion.
25. Determine the minimum inhibitory concentration of cefazolin for the culture of staphylococcus by the method of serial dilutions. Take stock, make a conclusion.
26. Set the thermoring precipitation reaction according to Ascoli in order to detect the antigens of the causative agent of anthrax in the studied extract from livestock raw materials. Take stock, make a conclusion.
27. Place the agglutination reaction on a glass with an unknown bacterial culture and typhoid diagnostic agglutinating serum. Take stock, make a conclusion.
28. Record the RZK with the patient's serum and gonococcal diagnostics, draw a conclusion.
29. To record and evaluate the results of the precipitation reaction in the gel, set for the purpose of determining the toxigenicity of the diphtheria corynebacterium cultures studied.
30. To record and evaluate the results of the extended agglutination reaction with the patient's serum and typhoid fever diagnostics.
31. Record and evaluate the results of the indirect hemagglutination reaction (INHA) performed with the patient's serum and erythrocyte tularemia diagnostic kit.
32. To record and evaluate the results of immunoenzymatic analysis (ELISA) in order to detect antibodies to the antigens of the causative agent of syphilis.
33. Determine the microbial count of drinking tap water.
34. To determine the coli index and coli titer of drinking water by the method of membrane filters. Evaluate the obtained results. Conclude.
35. Determine the total microbial count of the air in the classroom using the sedimentation method.
36. Study the culture of urine, which is done by the sector method (according to Gold) and establish the degree of its microbial population (bacteriuria) according to the calculation table.
37. Microscopy a smear made from vaginal secretions of a pregnant woman, determine the degree of purity of the subject's vaginal secretion.
38. To record phagotyping of staphylococcus strains isolated from: a) a postoperative patient; b) and c) medical staff of the surgical department. Determine the phage group and draw a conclusion.

The applicant's independent work involves preparation for practical classes and final class, mastering topics for independent work, preparation of abstract reports, presentations, tables. Control of mastering the topics of practical classes and independent work is carried out in practical classes and the final class and exam in the discipline.

Individual work includes researching scientific literature, preparing reviews on the given topics for presentation, performing scientific and practical research, participation in specialized Olympiads, scientific and practical conferences, competitions, scientific works.

Methodical recommendations for practical classes, independent work, lecture materials are available on the website of the department.

The way to get materials: EMU site/Student/Department of fundamental disciplines/Educational and methodological support of the department/"MICROBIOLOGY, VIROLOGY AND IMMUNOLOGY"/ or follow the link Department of fundamental disciplines/Discipline "MICROBIOLOGY, VIROLOGY AND IMMUNOLOGY". Materials are accessed from the student's Office 365-based corporate account.

5. Forms and methods of monitoring learning success

Current control in practical classes	Methods: individual oral survey, structured written works, test tasks with the choice of correct answers.
Control of mastering the thematic section of the discipline in intermediate control classes	Methods: oral or written survey, electronic testing, <i>methods of self-control and self-assessment</i> .
Final semester control	According to the regulation on control measures in EMU (regulation of EMU)
Final control of the discipline - <i>exam</i>	Methods: by exam cards in the form of an oral exam, monitoring of acquiring of practical skills (According to the Regulation on control measures in EMU (Regulation of EMU)).
Tools for diagnosing learning success	Theoretical questions, tests, clinically oriented situational tasks, practical tasks, demonstration of practical skills.

6. Evaluation criteria

Knowledge assessment is carried out according to regulation on control measures in EMU (regulation of DMI TNM).

Current control	According to the four-point system of traditional grades: 5 "Excellent", 4 "Good", 3 "Satisfactory", 2 "Unsatisfactory"
Control of practical skills	According to the four-point system of traditional grades
Exam	Based on a 200-point scale (the sum of points for the current academic activity of the student, the result of passing the exam and for successful completion of an individual task, if any) Credited: 120 to 200 points Not credited: less than 120 points (see Rating scale)
Final control for the discipline	The final control of students' academic performance is carried out after completing the study of the discipline and is implemented in the form of an exam.

Discipline assessment:	The score on the discipline is determined based on the results of assessment of current activities and is expressed using a fourpoint scale : ("Excellent", "Good", "Satisfactory", "Unsatisfactory"), multi-point scale and ECTS. The assessment in the discipline consists of an assessment of the current academic performance and the result of passing the exam (in points), which is set when evaluating theoretical knowledge and practical skills in accordance with the list defined by the discipline program. The number of points that the applicant scored for current academic.
	performance in the discipline is defined as the arithmetic mean of the number of points that the applicant received during the study of the discipline (practical, seminar, laboratory classes, etc.). The resulting value of the average traditional rating is converted to points according to the scale of conversion of traditional ratings to rating points. The maximum number of points is 200.

Matching grades on a 200-point scale, a 4-point (traditional) scale, and ECTS scale

On a 200-point scale	Rating on a 4-point scale
180–200	«5» Excellent
140–179	«4» Good
120–139	«3» Satisfactory
0–119	«2» Unsatisfactory

On a 200-point scale	ECTS evaluation
192–200	A
172–191	B
148–171	C
128–147	D
120–127	E
0–119	F

Discipline/course policy

The student has the right to receive high-quality educational services, access to up-to-date scientific and educational information, qualified advice during the study of the discipline and mastering practical skills. The policy of the department in the provision of Educational Services is student-centered, based on the regulatory documents of the Ministry of Education and the Ministry of Health of Ukraine, the Charter of the EMU and the procedure for providing educational

services regulated by the regulation on the organization of the educational process in the EMU and the principles of academic integrity.

Compliance with the EMU schedule, safety precautions in the classroom.

Requirements for preparing for practical classes.

Students should arrive at classes on time, without being late. A student who is more than 10 minutes late for classes is not allowed in and must work it out in accordance with the established procedure. During practical classes, the student must wear a work uniform (medical gown, cap). Students who do not have a work uniform are not allowed to attend classes. The student must follow the safety rules during practical classes and while staying in the Department's premises. When discussing theoretical issues, students should demonstrate tolerance, politeness and respect for their colleagues and the teacher; when performing practical tasks, the workplace should be kept in order and cleaned after completing practical work.

Use of mobile phones and other electronic devices. The use of mobile phones and other electronic devices in the classroom is not allowed, only during Distance Learning, provided that it is technically necessary.

Academic integrity. When studying the discipline, the student should be guided by the following regulations: on academic integrity of EMU (regulation of EMU). In case of violation of the regulations of academic integrity during the current and final controls, the student receives a grade of "2" and must work it out to the teacher in accordance with the established procedure.

Regulation on control measures in EMU (Regulation of EMU).

Skipping classes. Missed classes should be worked out in accordance with the procedure established in the regulations on control measures in the EMU (regulation of EMU) during the time determined by the work schedule (Department of fundamental disciplines) to the teacher on duty. To work out a missed lesson the student must pass a test and answer in writing or verbally the question on the topic of the lesson.

Procedure for admission to the final control in the discipline is given in the regulations on control measures and regulations on the organization of the educational process in the EMU (regulation of EMU) and regulations on control measures in the EMU (regulation of EMU). Students who do not have missed not worked out practical classes and lectures and have received an average traditional grade of at least "3" are allowed to participate in the final control.

Additional individual points. Points are awarded subject to the mandatory participation of the head, head teacher and teacher. These points are encouraging and are added once to the total score of the current academic performance and the result of passing the comprehensive exam. Their total number for one student should not exceed 10, and the final amount of points for an academic discipline should not exceed 200 points.

Individual tasks include:

- 1) writing essays and creating multimedia presentations with reports at meetings of the student scientific group of the department – 3 points;
- 2) participation in the creation of tables, graphological structure, posters on the topics of practical classes – 2 points;
- 3) participation in the student competition in the discipline at the First Stage – 1 point;
- 4) participation/prize-winner of the All-Ukrainian student competition in the discipline - 7/10 points;
- 5) author or co-author of abstracts/article – 2/5 points;
- 6) author or co-author of an oral/information stand report at a scientific conference – 6/3 points;
- 7) author of a student scientific paper accepted for participation or awarded by a diploma of I-III degree in the All – Ukrainian competition of student scientific papers at Stage II - 8 (participation) or 10 (diploma) points.

Resolving conflict issues. If there are misunderstandings and complaints against the teacher due to quality of educational services provided, knowledge assessment, and other conflict situations, the student must first report his/her claims to the teacher. If the conflict issue is not resolved, the student has the right to submit an appeal to the head of the department in accordance with the regulations on consideration of applications from applicants for higher education in EMU (regulation of EMU), Regulations on consideration of applications, complaints, and proposals of students in EMU (regulation of EMU), Regulations on meeting the requirements of the organization of the educational process (regulation of EMU), Regulation on the appeal of the results of the final control of knowledge of applicants for higher education in EMU (regulation of EMU), Regulations on safe educational environment in EMU (regulation of EMU).

Policy in the context of distance learning. The procedure for distance learning is regulated by regulation of EMU. The main training platforms for conducting training sessions are Microsoft Teams, Zoom. The procedure for conducting practical classes and lectures, working out and consultations during Distance Learning is published on the Department's Web page Department of fundamental disciplines.

Feedback from the teacher is provided directly during the lesson and/or consultation, and is also possible via email (in case of force majeure) during working hours.

Training resources

1. Educational and methodological support of the discipline is published on the website of the Department (Department of fundamental disciplines). Consultations are held according to the consultation schedule.
2. Schedule and distribution of groups by teacher are published on the Department's Web page (Department of fundamental disciplines).
3. Questions for intermediate and final control of the discipline are published on the Department's Web page (Department of fundamental disciplines).

Questions for the exam

1. Definition of microbiology as science. Areas of microbiology. The subject and tasks of medical microbiology. Main features and trends in the development of modern microbiology.
2. Discovery of microorganisms by A. Levenguk. Stages of microbiology development. Contributions of L. Pasteur and R. Koch to microbiology.
3. Formation of the main directions of microbiological science. The role of D. Samolovich, E. Jener, I. AND. Mechnikova, D. J. Ivanovsky, P. Ehrlich, S. M. Vinogradsky, E. Bering, G. Ramona, F. O. Lesha, G. Domagka, O. Fleming, D. K. Zaboltny, L. A. Zilbera, V. M. Zhdanova, M. P. Chumanov Development of microbiology in Ukraine.
4. Major differences between prokaryotes and eukaryotes. Forms of bacteria with a defect in cell wall synthesis, protoplasts, spheroplasts. L-forms of bacteria.
5. Morphology and structure of bacteria. The role of individual structures for the life of bacteria and in the pathogenesis of infectious diseases. Vegetative forms and spores.
6. Morphology and classification of protozoa.
7. Classification and morphology of fungi.
8. Microscopy techniques. Production of bacteriological preparations. Dyes and staining solutions, simple and complex staining methods.
9. Complex methods of staining microorganisms. Gram staining technique. Factors on which the staining of microorganisms according to Gram depends. Practical significance of the Gram staining method.
10. Principles of organization, equipment and mode of operation of bacteriological, serological and virological laboratories.
11. Bacterioscopic method of investigation. Stages.
12. Types and mechanisms of nutrition of microorganisms. Mechanisms of nutrient penetration into the bacterial cell. Chemical composition of microorganisms. Component values.
13. Nutrient environments, requirements for them. Classification of culture media used in microbiology.
14. Breath of microorganisms. Aerobic and anaerobic breathing types. Enzymes and structures of the cell involved in the respiration process. Methods of growing anaerobic bacteria.
15. Enzymes of microorganisms, their role in metabolism. Use to differentiate bacteria. Enzymes of pathogenicity.

16. Growth and methods of propagation of bacteria. Mechanism of cell division, bacterial culture multiplication phases under stationary conditions.
17. Bacteriological research method. Principles of isolation of pure bacteria cultures and their identification.
18. Effects of physical, chemical and biological factors on microorganisms. Sterilization, methods, control over the effectiveness of sterilization. Aseptica. Antiseptics.
19. Extrachromosomal bacterial heredity factors. Plasmids, their main genetic functions. Migratory elements. Integrins and superintrans. Role of mutations, recombinations and selection in microbial evolution. Major factors in evolution.
20. Chemotherapy and chemotherapy drugs. Chemotherapeutic index. Mechanism of antibacterial action of sulfonamides. The role of P. Ehrlich and G. Domagko in the development of the doctrine of chemotherapy.
21. Microbial antagonism phenomenon. The role of domestic microbiologists in the development of the doctrine of microbial antagonism. Antibiotics, definition, biological role in nature. Principles of receipt, units of measurement.
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 microbial sensitivity to antibiotics. Minimal inhibitory (MPC) and minimal bactericidal (MBC) concentrations. Practical significance. Principles for combating drug resistance of microorganisms.
24. Complications of antibiotic therapy. Dysbiosis. Antibiotic-resistant, antibiotic-dependent and antibiotic-tolerant strains of bacteria.
25. Infection. Factors that cause the emergence of the infectious process. Role of microorganisms in the infectious process. Pathogenicity, virulence, units of measurement, methods of determination. Pathogenicity factors of microorganisms, their characteristics.
26. Microbial toxins (exo- and endotoxins). Properties and chemical composition, obtaining, measuring the force of exotoxins. Role in the pathogenesis and immunogenesis of infectious diseases.
27. Phases of infectious process development. Mechanisms of infection by pathogens. Bacteremia, toxinemia, sepsis. Periods of infectious disease.
28. Role of macroorganism in the infectious process. Immunological reactivity of the child's body. The impact of the environment and social conditions on the emergence and development of the infectious process in humans. Gate of infection.
29. Immunity doctrine. Stages of immunology development. Types of immunity and forms of its manifestation.
30. Non-specific factors to protect the body from pathogenic microbes. Complement, its properties, activation paths. Cytokines.

31. Non-specific factors to protect the body from pathogenic microbes. Phagocytosis, phagocytic cell species. Phagocytosis stages. Completed and incomplete phagocytosis. Teaching about Toll receptors of phagocytes.
32. The body's immune system, its organs. Functions of the central and peripheral organs of the immune system.
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 immune response. Immunological reactions. Immunological tolerance, causes of its occurrence. Immunological memory, its mechanism.
35. Hypersensitivity of immediate and delayed type, their mechanisms, differences. Practical significance.
36. Three-cell system of cooperation of the immune response. The role of individual cells of the immune system, their interaction. Interleukins.
37. Antigens, their characteristics. Complete and defective antigens. Antigenic structure of bacteria. 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 sera. Units of measurement, practical use.
41. Serological reactions, their characteristics, basic types, practical use. Agglutination reaction, its mechanism, varieties. Practical use.
42. Serological reactions. Precipitation reaction, its mechanism. Use in medical practice. Gel precipitation reaction.
43. Serological reactions. Lysis reactions. Complement binding reaction, its practical use.
44. Reactions with labeled antibodies or antigens. Practical use of immunofluorescence reaction (REEF), enzyme-linked immunoassay and radioimmune assay.
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 immune system cells in the process of immune response.
48. Immune response responses, their characterization. Cellular immune response.
49. Hypersensitivity of immediate and delayed type. Mechanism of development of these reactions.
50. Monoclonal antibodies, their receipt and use in medical practice.
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