Examination questions on Microbiology, Virology, Immunology for 3rd year students (specialty General Medicine, Medical Faculty for International Students) 5 semester, 2025-2026 academic year

1. Microbiology: definition, subdivisions (fields and branches), links with other sciences, methods in medical microbiology. Aims of medical microbiology. Importance of microbiology for medical doctors. Achievements and concerns of microbiology in XXI century.
2. The main periods in the development of microbiology. Research of L.Pasteur, R.Koch, I.Mechnikov and their role in foundation of microbiology and the development of world science.
3. World of microorganisms. Common with other organisms and the unique features of microorganisms. Differences between prokaryotes and eukaryotes.
4. Taxonomy of microorganisms. Principles of systematics of microorganisms. Classification and nomenclature of bacteria. Taxonomic ranks. Vars (types), strains, clones, pure cultures. Species and criteria of species. The concept of the typical specie.
5. Principles of organization of bacteriological, virological, immunological laboratories, equipment and operation. Biosafety levels (BSL). Safety regulations for manipulation with pathogens of BSL-1 and BSL-2.
6. Biological specimens for microbiological studies: types, rules of specimen collection, transportation to the laboratory and storage. Specimen collection for anaerobic bacteria isolation.
7. Microscopic (bacterioscopic) method of examination: tasks, procedure, evaluation of the method: advantages, disadvantages. Types of microscopic preparations. Heat-fixed smear preparation. Basic morphological forms of bacteria.
8. Staining microscopic preparations: simple and differential stains: examples, purposes, staining properties. Gram staining: medical application, principles, procedure. Techniques of microorganisms' microscopy. Types of microscopes. Principles and applications of bright-field, dark-field, phase-contrast, fluorescence, and electron microscopy. The technique of oil immersion microscopy.
9. Structure of the bacterial cell. Bacterial core: cytoplasm, cytoplasmic structures (cytoplasmic membrane, mesosomes, nucleoid, ribosomes, inclusions): structure, functions, methods of the detection.
10. Bacterial cell surface structures (capsule, cell wall, flagella, pili). The composition and function, of bacterial cell wall. The structure of peptidoglycan. Gram staining. The cell wall of gram-positive and gram-negative bacteria. Bacteria with defective cell wall (spheroplasts, protoplasts, L-forms). Factors inducing cell wall removal, medical importance of L-forms. Acid-fast bacteria and unique properties of their cell wall, role in pathogenicity. Methods of acid-fast staining: medical application, principle.
11. Features of a metabolism and energy exchange in microbes. Enzymes of microbes, classification. Types of bacterial secretory systems.
12. Nutrition of microorganisms. Source of macro- and micronutrients, growth factors. Nutritional types. Mechanisms of nutrient transportation in to the cell.
13. Strategies in energy production in microorganisms. Aerobic and anaerobic respiration. Enzymes and cell structure involved in respiration in microorganisms. Classification of bacteria by their requirements in oxygen.
14. Growth and reproduction of bacteria. Mechanisms and phases of bacterial division. Phases of bacterial population growth on nutrient media (bacterial growth curve).

15. Resting forms of microorganisms. Bacterial endospores: medical importance, properties of an endospore, the stages of endospore formation, detection methods (principles, procedures).

16. Bacteriological method of laboratory diagnosis: tasks, procedure, evaluation of the method.

17. Cultivation of microorganisms. Conditions required for growth. Nutrient media for culturing bacteria: classification and characteristics. Culture media ingredients, procedure of preparation and sterilization. General requirements to bacteriologic nutrient media.

18. Methods of pure culture isolation of aerobic, facultative anaerobic and obligate anaerobic microorganisms. Cultivation of anaerobic bacteria: culture media, techniques, equipment.

19. Identification of microorganisms: morphological, cultural, serologic, biological, genetic. Bio- chemical identification of microorganisms. Detection of: a) proteolytic enzymes; b) carbohydrate hydro- lyses enzymes; c) lipolytic enzymes; d) oxidative- reductive enzymes; e) hemolysins. Automatic stations for identification of bacteria. Identification of microorganisms without pure culture isolation.

20. The structure of bacterial genetic apparatus. General properties and varieties of plasmids. Detection of plasmids. Mobile genetic elements: transposons and IS elements.

21. Bacterial varibility: phenotypic and genetic. Mechanisms of genetic variability: mutations and recombination. Classification of mutations. Horizontal gene transfer: transformation, transduction, conjugation. Practical significance of bacterial variability in diagnostics, therapy and prevention of infectious diseases.

22. Molecular methods in diagnosis of infection diseases: aims, methods, advantages. Genetic mapping of DNA of microorganisms. Genetic engineering. Gen cloning. Genomics and proteomics.

23. Molecular hybridization and polymerase chain reaction: principles, procedures, reaction stages. DNA fragments analysis in diagnostics. Molecular typing of microorganisms. Sequencing of microbial genome.

24. Ecology of microorganisms. Basic terminology of ecology. Interspecific and intraspecific relations. Symbiosis, its variants. Antagonistic microbial relationships, its background and medical importance. Bacteriocins. The role of microorganisms in the origin and development of the biosphere (the concept of microbial dominant). Distribution of microorganisms in the nature.

25. Diversity of normal flora at different sites of human body: indigenous microflora of the skin, mouth, respiratory tract, gastrointestinal tract, urogenital system. Origin of the normal flora. Beneficial effects of the normal flora. Methods of normal flora investigation. Metagenomics approach for normal microflora study. Gnotobiology.

26. Dysbiosis: etiology, pathogenesis, symptoms, approaches to treatment, prophylaxis.

27. Effect of physical and chemical factors on microorganisms. Antimicrobial measures (direct and indirect). Asepsis. The antimicrobial regiment in hospitals.

28. Sterilization: definition, methods of sterilization (physical, chemical, mechanical), quality control. Sterilization of instruments and medical devices. Consequences of insufficient sterilization.

29. Disinfection: definition, methods of disinfection, quality control of disinfection. Disinfectants: classification and modes of action.

30. Antisepsis: definition, methods of antisepsis. Antiseptics: classification and modes of action.

31. Doctrine of infectious process: the definition, basic terminology of infectiology. Causes of infectious disease emergence. Differences between communicable and non-communicable

diseases. Periods in development of infectious diseases. Outcomes of infectious disease.

32. Evolution of microorganisms and infectious diseases. Positive and negative changes in infectious pathology in the second half of the 20th century and the beginning of the 21st century. Emerging and re-emerging infections.

33. Role of microorganisms in infectious process: pathogenicity and virulence: the definition, characteristics, genetic control. Pathogenicity islands. Secretory systems and their role in pathogenicity. Intracellular parasitism of microorganisms (except viruses).

34. Pathogenicity factors (virulence) of microorganisms: adhesins, invasins, impedins, agressins, modulins, allergens.

35. Bacterial toxins, features of exotoxins and endotoxin. Types of exotoxins and their biological properties and mechanisms of impairment.

36. The role of the macroorganism in the infectious process development. Importance of heredity and lifestyle of the individuals, natural, social and environmental factors in an infection development. Mechanisms of persistence of microorganisms.

37. Classification of infectious diseases and examples of them (according to pathogen types, to manifestation, severity, duration, recurrence of pathogen, the number of pathogens

38. Classification of infectious diseases and examples of them (according to routs of infection transmission, source of infection, site of infection, spread in the host and in the world, the degree of infectiousness, origin of pathogen, place of infection acquisition).

39. The source of infections. Modes and routs of infection transmission. Zoonoses, anthroponoses and sapronoses. Vertical and parenteral route of infection transmission. Microbiological methods for the detection of sources of an infection and factors of transmission.

40. Biological method (application of laboratory animals in microbiology): tasks, steps, evaluation of the method. Animal models for infection diseases. Routs for laboratory animal infection. Ethical, humane and legal considerations involved in the use of laboratory animals.

41. Chemoprophylaxis and chemotherapy; antimicrobial chemotherapeutic agents and antibiotics. Properties of chemotherapeutic agents. Chemotherapeutic index.

42. Antibiotics: characteristics, classifications by origin, chemical structure, and mechanisms of action on microbial cells. Narrow-spectrum and broad-spectrum antibiotics, bacteriostatic and bactericidal antibiotics. Antibiotics of major chemical classes.

43. Empiric antimicrobial therapy. Adverse effects of antibiotics. Principles of rational antibiotic therapy. Prophylactic use of antibiotics.

44. The problem of resistance to antimicrobials: definitions (intrinsic, acquired resistance (primary and secondary), significance. Resistance mechanisms: non-genetic and genetic origin of drug resistance. Biochemical basis for resistance to antibiotics. Categories of resistance: MDR (Multi-Drug Resistance), XDR (extensive Drug Resistance), PDR (Pan Drug Resistance).

45. Genotypic and phenotypic methods for determining microorganism susceptibility to antibiotics. Disc diffusion method, E-test (epsilometric method), dilution techniques in liquid and solid media: procedures, interpretation, and assessment of results. Automated and rapid susceptibility testing methods. Criteria and breakpoints for microorganism sensitivity to antibiotics.

46. Immunology: definition, objectives, methods, history of development, direction. Role of Immunology in the medical practice.

47. The immune system. Central (primary) and peripheral (secondary) organs of the immune

system. Immunocompetent cells: classification, functions.

48. Molecules of the I and II classes of major histocompatibility complex (MHC): structure and functions. CD-nomenclature of cell surface molecules.

49. Immune system molecules. Adhesion molecules (immunoglobulin superfamily molecules, integrins, selectins, mucins, cadherins): structure, function, examples.

50. Cytokines: definition, main groups, function. Interleukins, chemokines, tumor necrosis factor: structure and functions. Colony stimulating factors.

51. Immunity: definition, types of immunity. Innate and acquired immunity. Natural and artificial, active and passive, post-infectious and infectious (non-sterile) immunity, local immunity. Maternal immunity: mechanisms, importance.

52. Immune and non- immune factors of innate immunity. Mechanisms of recognition in the innate immunity.

53. The complement system: definition, main components and factors characteristics, activators and activation pathways, functions of components and their fragments.

54. The complement system control mechanisms. Complement and diseases. Methods of evaluation of the complement system activity.

55. Phagocytes, classification. Phagocytosis reaction: phases, mechanisms of intracellular microorganisms killing, outcomes. Methods of phagocytosis evaluation. Phagocytic reaction indexes, definition and importance in clinical practice.

56. Antigen presenting cells: populations, localization. Antigen processing and presentation. Natural killer cells and mechanisms of cytotoxicity.

57. Antigens: structure, properties, classification according to functional activity, immunogenicity, routs of entry to the body, degree of foreignness, type of immune response induced. T-dependent and T- independent anti- gens. Superantigens. Haptens.

58. Antigens of microorganisms. Antigenic structure of bacteria. Type, species, group antigens. Protective antigens. Cross- reactive antigens, medical importance.

59. B cells: development, markers, antigen-specific B cell receptor. Methods for assaying of B-lymphocytes amount and functional activity.

60. Immune response: definition, conditions for development. Humoral immune response: definition, development. Activation, proliferation, differentiation and interactions of cells involved. Elimination of antigen. T-dependent and T- independent response.

61. Antibodies (immunoglobulins): structure, properties. Antibodies classification: classes, sub- classes, isotypes, allotypes, idiotypes. The mechanism of antibodies and antigens interaction: specificity, phases, manifestations. Affinity and avidity.

62. Primary and secondary humoral immune response. The dynamics of the development of the humoral immune response. Control of immunoglobulin biosynthesis. Immunoglobulin genes.

63. T cells: development, markers, subpopulations. Helper T-cells, main types (Th1, Th2, Th3, Th17), spectrum of cytokines produced. Control of the immune response of T lymphocytes (Th3, T- regulators, CD4+CD25+T-cells). Methods for assaying of the amount and functional activity of T- ymphocytes.

64. T-cell receptor: structure, types, genetic control, variety. T-dependent antigens. T- cell epitopes. T-cell restriction. Activation of T- lymphocytes. Costimulation. The model of two (three) signals. Anergy, apoptosis.

65. Cellular immune response: definition, development, main stages, manifestation.

Activation, proliferation, differentiation and interaction of cells involved. Immunological memory.

66. Transplantation immunity. Histocompatibility antigens. Graft reaction types, mechanisms of development, prevention. Immunological tolerance: mechanisms, significance.

67. Anti-infective immunity. Innate and acquired mechanisms of antitoxic, antibacterial, antifungal, antiparasitic immunity. Protective immunity.

68. Serological method of diagnostics: general definition, objectives, basic concepts (diagnosticum, diagnostic serum, titer, diagnostic titer, seroconversion, paired sera). Samples for serological examination. General characteristics of the method and basic principles of serological reactions. Application of serological method for infectious and non-infectious diseases diagnostics.

69. Agglutination test: ingredients, main variants of performance, registration of results, evaluation, application. Co-agglutination reaction.

70. Indirect (passive) and reverse passive agglutination: ingredients, mechanism, practical use. Hemagglutination reaction, latex agglutination test.

71. Immunoprecipitation reaction: ingredients, mechanism, main methods of performance, application. Reaction of the immune lysis.

72. Solid phase immunoassay reactions. Immunofluorescence (fluorescent antibodies test, FAT), main variants. Radioimmunoassay (RIA). Immune electron microscopy (IEM). Practical application of the FAT, RIA, IEM.

73. ELISA: ingredients, mechanisms, variants of performance, results recording, evaluation, spheres of application. 3-d and 4-th generation ELISA test-systems. Immunoblotting, practical application.

74. Immunoprophylaxis and immunotherapy of infectious diseases: definitions, achievements and challenges. Active immunoprophylaxis. Vaccines: requirements, the concept of "ideal vaccine." Adjuvants and their mechanisms of action. Main types of vaccines: live, inactivated (corpuscular, chemical, conjugated, split, subunit), toxoids, recombinant vaccines. Combination vaccines and their advantages.

75. New approaches for vaccine development: (vector vaccines, DNA vaccines, mRNA-vaccines, with MHC gene products, reverse vaccinology). Adverse effects of vaccination: sever post-vaccination reactions, post-vaccination complications.

76. Post-vaccination immunity: mechanisms and factors influencing its development. Primary and secondary immune response. Booster immunization. Indications and contraindications to vaccination. Immunization schedule. The Expanded Programme on Immunization.

77. Passive immunoprophylaxis and immunotherapy of infectious diseases: indications, principles, complications. Classification of serum preparations (specificity, the manufacturing method, object of the action of antibodies, purpose). The preparations of immunoglobulins. Blood plasma preparations. Monoclonal antibody: principles of production, application.

78. Collective immunity to infectious diseases, importance. Immune stratum (population): evaluation methods, causes and consequences of its decrease.

79. Allergology: the definition, objectives. Allergens: structure, cross-reacting allergens, examples of allergens. Allergy: the stages of development, types of reactions. The concept of ecological immunology and allergology.

80. Immediate type hypersensitivity (ITH). Mediator type (I) ITH: allergens, mechanism, development, manifestation. Anaphylaxis. Passive anaphylaxis. Ways to prevent anaphylaxis. Atopy: the mechanism and conditions for the development, clinical forms.

81. Cytotoxic (II) type ITH: allergens, development, mechanisms, manifestations. Immunocomplex (III) type ITH: allergens, development, mechanisms, manifestations.

82. Delayed type of hypersensitivity (IV): allergens, development, mechanism. Infection and con- tact allergy.

83. Drug allergy: major allergens, the mechanisms and types of allergic reactions, methods for diagnostics and prevention.

84. Food allergy. Main allergens. Prevention of food allergy. Paraallergy. Idiosyncrasy.

85. Allergic method of investigation: definition, objectives, general characteristics.

86. Clinical Immunology: definition, objectives, main concepts. Immune status, methods of evaluation (standard screening tests, functional and advanced methods).

87. Immunodeficiency states: classification, causes of development, methods for detection, principles for correction.

88. Autoimmune diseases: definition, classification, etiology, mechanisms of tissue damage, manifestations. Principles of treatment. Prophylaxis.

89. Antitumor immunity. The concept of immune surveillance. Characteristics of tumor antigen. Mechanisms of tumor escape from immune surveillance.

90. Immunotherapy: definition, concepts, indications, drugs.

91. Staphylococci: classification, characterization, antigenic structure, pathogenicity factors. Staphylococcal infections: pathogenesis, immunity, microbiological diagnosis and principles of prevention, immunotherapy. Staphylococcal food poisoning. Empiric antibiotics for staphylococcal diseases treatment. Resistance to antibiotics: MRSA, VRSA. Staphylococcal carriage.

92. Streptococci: classification (Lancefield's groups, hemolytic groups), characterization, antigenic structure, pathogenicity factors. Streptococcal disease: group A, group B, group D streptococcal infections, pathogenesis, immunity, microbiological diagnosis, therapy and prevention. Scarlet fever: etiology, rout of transmission, mechanism of development).

93. Pneumococci: classification, characterization, antigenic structure, pathogenicity factors. Pneumococcal infections: pathogenesis, immunity, microbiological diagnosis, resistance to antimicrobials, prevention. Empiric antibiotics for pneumococcal infections treatment. Enterococci: characteristics, role in human pathology. Vancomycin-resistant enterococci.

94. *Neisseria meningitidis:* systematics, characterization, antigenic structure, pathogenicity fac- tors. Meningococcal infections: pathogenesis, therapy, microbiological diagnosis, prophylaxis.

95. *Neisseria gonorrhoeae*: systematics, characterization, antigenic structure, pathogenicity fac- tors. Pathogenesis, immunity, microbiological diagnosis and prophylaxis of gonorrhoea. Prevention of gonorrhoea and gonococcal conjunctivitis.

96. Characteristics of gastrointestinal infections (GTI). Family of Enterobacteria: classification, characterization, pathogenicity factors. Microbiological diagnosis of GTI: biological specimen collection, transportation, methods for biological specimen enrichment. Culture media for Enterobacteria. Principles of enterobacteria identification to the species level. Resistance to antibiotics in Enterobacteria. Extended spectrum beta-lactamases and carbapenemases producing Enterobacteria.

97. Escherichia: characteristics, antigenic structure, factors of pathogenicity. Opportunistic *Escherichia coli,* biological role. *E.coli* and urinary tract infections. Groups of enteropathogenic (diarrheogenic) *E.coli*. Escherichiosis: pathogenesis, immunity, microbiological diagnostics, prevention.

98. Salmonella: systematics and classification, characterization, antigenic structure (Kauffmann- White classification), pathogenicity factors, role in pathology. Salmonellosis: etiology, pathogenesis, immunity, microbiological diagnosis, prevention. Empiric antibiotics for Salmonella diseases treatment.

99. Causative agents of typhoid fever and paratyphoid fever: characteristics, antigenic structure of causative agents, pathogenicity factors. Vi-antigen, it's role. Typhoid and paratyphoid fever: pathogenesis, immunity, and prevention.

100. Methods of typhoid and paratyphoid fever laboratory diagnostics depending on the disease stage. Isolation of S.typhi and paratyphi from blood and stool samples. Serological diagnosis of typhoid and paratyphoid fever. Diagnosis of S.typhi carriage.

101. Shigella: classification, characteristics, antigenic structure, pathogenicity factors. Shigellosis (bacterial dysentery): pathogenesis, immunity, microbiological diagnosis, prophylaxis, antimicrobials active against shigella.

102. Klebsiella: classification, characteristics, antigenic structure, pathogenicity factors. Klebsiella diseases. Resistance of Klebsiella to antimicrobials, combination of antibiotics for treatment of totally resistant Klebsiella. Scleroma and ozena: pathogenesis, immunity, microbiological diagnosis, principles of treatment.

103. Yersinia enterocolitica: systematics, characteristics, antigenic structure, pathogenicity factors. Yersiniosis: pathogenesis, immunity, microbiological diagnosis, prevention. Antimicrobials active against enteropathogenic yersinia.

104. Listeria: classification, characteristics, antigenic structure, pathogenicity factors, role in pathology. Lysteriosis in pregnant females.

105. *Campylobacter spp.*: systematics, characteristics, antigenic structure, pathogenicity factors. Campylobacteriosis: pathogenesis, immunity, microbiological diagnosis, prevention. Antimicrobials active against *Campylobacter spp*.

106. *Helicobacter spp.*: systematics, characteristics, antigenic structure, pathogenicity factors. Helicobacteriosis: pathogenesis, immunity, microbiological diagnosis, prevention, treatment.

107. Non-fermenting gram-negative bacteria. Pseudomonas: classification, characteristics, antigenic structure, pathogenicity factors, role in pathology. Microbiological diagnosis of *Pseudomonas aeruginosa* infection. Acinetobacteria: characteristics, role in pathology.

108. Food born infections: etiology, classification, pathogenesis, principles of microbiological diagnosis, prevention.

109. Actinomyces: classification, characterization, antigenic structure, pathogenicity factors. Actinomycosis: pathogenesis, etiology, pathogenesis, immunity, microbiological diagnosis, prophylaxis, antimicrobials active against Actinomyces spp.

110. Mycobacteria: classification, characteristics, antigenic structure, pathogenicity factors. Tuberculosis: pathogenesis and immunity. TB and HIV. Non-tuberculous mycobacteria.

111. Diagnostics of tuberculosis: microscopy, culture method, molecular genetic methods, Mantoux test (tuberculin test), quantiferon test (Interferon-Gamma Release Assays). Tuberculosis treatment. MDR and XDR tuberculosis.

112. Corynebacterium: classification, characteristics, biotypes, antigenic structure, pathogenicity factors. Diphtheria: pathogenesis, immunity, microbiological diagnostics and immunotherapy and etiological therapy of diphtheria, prophylaxis.

113. Diphtheria toxin: structure, biological effect, target cells. Upregulation and downregulation of toxin-production. Carriage of non-toxigenic *Corynebacterium diphtheria*: diagnostics, remediation of carriers. Diphtheria toxoid. Control of post-vaccination immunity.

114. *Bordetella:* classification, characteristics, antigenic structure, pathogenicity factors. Whooping cough: pathogenesis, immunity, microbiological diagnosis, prophylaxis. Sampling. Empiric antibiotics for pertussis treatment. Contemporary trends in vaccination against pertussis.

115. *Haemophilus spp.:* classification, characteristics, antigenic structure, pathogenicity factors. *Haemophilus influenzae*: pathogenesis, immunity, microbiological diagnosis, prevention. Antimicrobials active against *Haemophilus influenzae*. Hib epiglottitis; precautions in samples collection for laboratory diagnostics.

116. *Legionella:* classification, characteristics, pathogenicity factors, role in pathology. Antimicrobials active against Legionella. Coxiella: classification, characteristics. Q fever.

117. Ecological group of anaerobic bacteria, characteristics. *Clostridium tetani:* systematics, characterization, antigenic structure, pathogenicity factors. Tetanus: pathogenesis, immunity, microbiological diagnosis, prevention, etiological treatment. Neonatal tetanus.

118. *Gas gangrene Clostridia:* classification, characteristics, antigenic structure, pathogenicity factors. Clostridial myonecrosis: pathogenesis, immunity, microbiological diagnostics and prophylaxis, etiological treatment, immunotherapy.

119. *Clostridium botulinum*: systematics, characterization, antigenic structure, pathogenicity fac- tors. Botulism: pathogenesis, immunity, microbiological diagnostics, etiological therapy and prevention. Character traits of anaerobic infections. Clostridial gastroenteritis and colitis. *Clostridium difficile* as a nosocomial pathogen, role in pathology, antimicrobials active against *C. difficile*.

120. Nonsporforming gram-positive and gram-negative anaerobes: classification, characteristics, role in pathology. Principles of an- aerobic microbiological diagnosis of infections caused by nonsporforming anaerobes.

121. Highly dangerous infections: characteristics, classification. Principles of collection, transportation and investigation of specimens with pathogens of 3d and 4th biosafety levels. Rapid diagnostic methods for diagnosis highly dangerous infections. Bioterrorism.

122. Vibrio: classification, characteristics, antigenic structure, pathogenicity factors. Cholera: pathogenesis, immunity, microbiological diagnosis, prevention. Antimicrobials active against *V.cholerae*. The role of non-O1 *V.cholerae, V.parahaemolyticus* in human pathology.

123. *Yersinia pestis*: systematics, characteristics, antigenic structure, pathogenicity fac- tors. Plague: pathogenesis, immunity, microbiological diagnosis, prevention.

124. *Francisella tularensis:* systematics, characteristics, antigenic structure, pathogenicity fac- tors. Tularemia: pathogenesis, immunity, microbiological diagnosis, prevention.

125. Brucella: classification, characteristics, antigenic structure, pathogenicity factors. Brucellosis: pathogenesis, immunity, microbiological diagnosis, prevention.

126. Bacilli: classification, characteristics, antigenic structure, pathogenicity factors. Anthrax: pathogenesis, immunity, microbiological diagnosis, prevention.

127. General characteristics and classification of spirochetes. Leptospira: properties, serovars, pathogenicity factors. Leptospiroses: epidemiology, pathogenesis, immunoprophylaxis, microbiological diagnosis.

128. Treponema: classification, characteristics, antigenic structure, pathogenicity factors. Syphilis: pathogenesis, immunity, microbiological diagnosis, prevention. Congenital syphilis, prevention. Fusospirochetosis.

129. Borrelia: classification, characteristics, antigenic structure, pathogenicity factors. Relapsing fever and tick born borreliosis: aetiology, pathogenesis, immunity, microbiological diagnosis. Lyme borreliosis: etiology, pathogenesis, immunity,

microbiological diagnosis, prevention.

130. Rickettsia: classification, characteristics, antigenic structure, pathogenicity factors. Epidemic typhus and relapsing: etiology, pathogenesis, immunity, microbiological diagnosis, prevention. Murine typhus: etiology, pathogenesis, prevention.

131. Chlamydia: classification, characteristics, development cycle, antigenic structure, pathogenicity factors. Diseases caused by chlamydia: etiology, pathogenesis, immunity, microbiological diagnostics, sampling of material for research, prevention.

132. Mycoplasma: classification, characteristics, pathogenicity factors. Mycoplasma infections: pathogenesis, immunity, microbiological diagnosis and prevention.

133. Virology: definition, objectives, methods. Systematic position and classification of viruses. History. D.Ivanovsky works importance.

134. Forms of existence of viruses. Morphology and biochemical structure of virions. Viral genome organization. Structure, function and properties of virion nucleic acid, proteins, lipids and carbohydrates.

135. Interaction of the virus and susceptible cell. Strict parasitism and cytotropism of viruses. Cell receptors for viruses. Reproduction strategy of DNA and RNA viruses.

136. Types of viral infection of cell. Changes in the host cells in the process of a viral infection. Peculiarities of viral infections of an organism. Acute, chronic and slow infection.

137. Factors of innate and adaptive antiviral immunity. Control of viral reproduction by the immune system. Interferons: classes, properties, mechanisms of antiviral activity.

138. Cultivation of viruses. Cell culture: types, methods of infection. Indication and identification of viruses in cell culture. Types of cytopathic effects (CPE). Viral inclusion: the nature, location, diagnostic value.

139. Cultivation of viruses in the chick embryo: methods of infection, indication and identification of viruses. Cultivation of viruses in laboratory animals: methods of infection, indication and identification of viruses.

140. Principles of etiological diagnostics of viral infections. Rapid methods. The serologic diagnosis of viral infection Hemagglutination/Hemadsorption inhibition test: principle, application. Neutralization test: mechanisms, performance, registration, application.

141. Principles of viral infections chemotherapy. Group of antiviral drugs. Viral load, methods of its determination.

142. The etiology of acute respiratory viral infections. Influenza viruses: classification, characteristics. Dissimilarities between influenza viruses. Influenza: pathogenesis, immunity and prevention. Rhino- viruses: classification, characteristics, role in human pathology.

143. Influenza A viruses: genome, properties and functions of proteins of the virion, the antigenic structure and its variability. Chemotherapy and chemoprophylaxis of influenza. Viruses of "bird" and "swine" flu.

144. Etiologic diagnostics of influenza: the material for the study, methods, evaluation of results. Differentiation of influenza and parainfluenza viruses.

145. Paramyxoviruses: classification, characteristics, role in pathology. Parainfluenza viruses: structure, properties, serotypes. Pathogenesis, immunity, diagnostics, specific prevention of mumps.

146. Measles virus: classification, characteristics. Measles: pathogenesis, immunity and prevention. Subacute sclerosing panencephalitis. Epidemiological situation in Europe and in the World regarding measles. Mitigated measles.

147. Coronaviruses: classification, characteristics, sensitivity to the physical and chemical factors. SARS-CoV coronavirus, severe acute respiratory syndrome (SARS). MERS-CoV coronavirus, Middle East respiratory syndrome (MERS).

148. SARS-CoV-2 coronavirus. Coronavirus infection COVID-19: pathogenesis, immunity, etiological diagnosis, prevention, vaccine development, approaches for treatment, epidemiological situation in Europe and in the World.

149. Rubivirus: systematics, characteristics. Rubella: pathogenesis, etiologic diagnosis, prevention. Congenital rubella syndrome.

150. Ecological group of arboviruses: classification, characteristics. Arbovirus infections: pathogenesis and clinical features. Tick-borne encephalitis: pathogenesis, etiological diagnosis, prophylaxis. Other arbovirus infections caused by flaviviruses.

151. Ecological subgroup of roboviruses. Hemorrhagic fever virus with renal syndrome: characteristics, role in pathology. Arenaviruses: characteristics, role in pathology. Filoviruses: classification, characteristics. Ebola fever: pathogenesis, prevention. Marburg virus disease.

152. Rabies virus: classification, characteristics, specific inclusion. Rabies: pathogenesis, etiologic diagnosis, prevention. L. Pasteur's research and its importance.

153. Viruses as etiological agents of GIT-infections. Enteroviruses: classification, characteristics. Enterovirus infections: pathogenesis, prevention.

154. Polio viruses: classification, characteristics. Poliomyelitis: pathogenesis, immunity, etiologic diagnosis, prevention. Vaccine-associated polio.

155. Rotaviruses: classification, characteristics. Rotavirus infections: pathogenesis, prevention. Norovirus (Norwalk virus).

156. Enteric hepatitis viruses. Hepatitis A virus: classification, characteristics. Viral hepatitis A: pathogenesis, immunity, etiologic diagnosis, prevention. Hepatitis E virus: classification, characteristics, role in pathology, etiological diagnostics, prevention.

157. Parenteral hepatitis viruses: classification, characteristics. Hepatitis B virus: systematics, characteristics, antigens. Parenteral hepatitis B: pathogenesis, immunity, etiologic diagnostics, therapy, prevention. Diagnostic significance of detection of HBV DNA, IgG and IgM against antigens, and viral antigens. Hepatitis D virus: systematics, characteristics, etiologic diagnostics, prevention.

158. Hepatitis C virus: systematics, characteristics, antigens. Parenteral hepatitis C: pathogenesis, immunity, etiologic diagnostics and therapy, prevention. Diagnostic significance of detection of HCV RNA, antibodies IgG and IgM against core-Ag, NS-proteins.

159. Retroviruses. H Human immunodeficiency viruses (HIV-1, HIV-2): virion morphology, virus genome, antigenic structure. HIV reproduction.

160. HIV infection: pathogenesis, immunity, etiologic diagnostics, principles of therapy, highly active antiretroviral therapy (HAART), prophylaxis. AIDS-Defining Illnesses. Prophylaxis of professional HIV infection in medical personal.

161. DNA viruses: classification. Adenoviruses: classification, characteristics. Adenoviral infections: pathogenesis, immunity, etiologic diagnostics. Human bocavirus: characteristics, role in pathology. Smallpox: specific prevention, eradication.

162. Herpesviruses: classification, characteristics, reproduction. Human disease caused by the herpes simplex viruses: pathogenesis of herpetic infections, immunity, virological diagnostics, chemotherapy and immunotherapy.

163. Varicella and herpes zoster: etiology, pathogenesis, virological diagnosis, prevention. The

role of herpesvirus types 4-8 in human pathology. Diagnosis of Epstein-Barr Virus (EBV) and Cytomegalovirus (CMV) Infections. Kaposi's Sarcoma Virus.

164. Oncogenic DNA and RNA viruses. Viral and cellular oncogenes. Mechanisms of viral onco- genesis. Changes in the cells in the process of tumor transformation.

165. Papillomaviruses: characteristics, role in human pathology. Prevention of human papillomavirus infections.

166. Slow infections. Prions: characteristics, role in pathology. Prion diseases: laboratory diagnostics, prevention.

167. Bacterial viruses (phages): properties, classification. Interaction of virulent and temperate phages with susceptible bacteria. Temperate phages. Lysogeny. Practical use of bacteriophages: phage typing, phage therapy and prophylaxis.

168. Pathogenic fungi: classification, characteristics. Fungal infections promoting factors and conditions. Fungi which causes superficial, systemic (deep) and molds invasions. Principles of etiologic diagnostics of fungal infections.

169. Candida: classification, characteristics, pathogenicity factors. Candidiasis: pathogenesis, etiologic diagnostics, prevention. Pneumocystis: characteristics, role in human pathology.

170. Pathogenic protozoa: classification, characteristics. Invasion and immunity in protozoan invasions.

171. Classification and characteristics of pathogens, pathogenesis, immunity and methods for etiologic diagnostics of malaria, toxoplasmosis and trichomoniasis.

172. Classification and characterization of pathogens, pathogenesis, immunity, methods for etiologic diagnostics of amebiasis, balantidiasis, giardiasis, cryptosporidiosis.

173. Clinical microbiology: Definition, goals. Opportunistic pathogens. Features of the infections caused by opportunistic pathogens.

174. Microbiological diagnosis of diseases caused by opportunistic pathogens. Criteria for estimation of isolated bacteria role in opportunistic disease development.

175. Etiology and principles of microbiological diagnosis of opportunistic infections of the skin and subcutaneous tissue.

176. Etiology and principles of microbiological diagnosis of bacteremia and sepsis.

177. Etiology and principles of microbiological diagnosis of opportunistic respiratory tract infections. Etiology and principles of microbiological diagnosis of opportunistic urinary tract infections.

178. Nosocomial (Healthcare-associated) infections: definition, importance, etiology, distribution, microbiological diagnosis, prevention. E.S.K.A.P.E. pathogens. Hospital clones of bacteria: examples and their resistance and sensitivity to antibiotics profiles. Prevention of nosocomial infections.

LIST OF PRACTICAL SKILLS
to be taken on the exam day before the theoretical exam

- Students are allowed to take the theoretical exam if they have successfully passed the 1st stage (practical skills passed with a grade of "4" or higher).
- The grade on Practical skills exam will make up 10% of the Final exam grade.
- Each student will have to pass 2 skills: morphological identification of a microorganism by immersion microscopy (##4–16) and another skill from the list below.

1. Prepare a fixed smear from a broth culture of bacteria.
2. Prepare a fixed smear from agar culture of bacteria.
3. Stain the fixed smear using the Gram method.
4. Perform oil immersion microscopy of a fixed smear.
5. Find and morphologically identify staphylococci in a pure culture smear, stained by the Gram method
6. Find and morphologically identify streptococci in a pure culture smear, stained by the Gram method.
7. Find and morphologically identify *Escherichia coli* in a pure culture smear, stained by the Gram method.
8. Find and morphologically identify Staphylococcus aureus and *Escherichia coli*, in a mixed culture smear, stained by the Gram method.
9. Find and morphologically identify *Bacillus anthracis* in a pure culture smear, stained by the Gram method.
10. Find and morphologically identify *Vibrio cholerae* in a pure culture smear, stained by the Gram method.
11. Find and morphologically identify *Brucella spp.* in a pure culture smear, stained by the Gram method.
12. Find and morphologically identify encapsulated bacteria *(Klebsiella)* in a pure culture smear, stained by Burri-Gins method (negative staining).
13. Find and morphologically identify *Neisseria gonorrhoeae* in a smear of pus from urethra, stained by the Gram method.
14. Find and morphologically identify acid-stable *Mycobacterium tuberculosis* in a smear of sputum, stained by the Ziehl-Nielsen method.
15. Find and morphologically identify *Corynebacterium diphtheriae* in a pure culture smear, stained by the Loeffler method.
16. Find and morphologically identify *Candida* in a pure culture smear, stained by the Gram method.
17. Evaluate the results of microbial culture susceptibility/resistance to antibiotics using disk-diffusion method (Kirby-Bauer Test).
18. Perform and evaluate of the slide agglutination test to identify enterobacteria.
19. Evaluate the results of the passive (indirect) hemagglutination test to assess the immunity.
20. Evaluate the results of the hemagglutination inhibition test for seroidentification of influenza virus.
21. Evaluate the results of the hemagglutination inhibition test for serodiagnosis of viral infection.

Exam questions discussed and approved at a meeting of the department (10.12.2025, protocol #7)

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Microbiology, virology, immunology,
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