EDUCATIONAL PLAN

Name of the subject: MEDICAL MICROBIOLOGY

Educational degree: Master

Type of the subject: Obligatory

Duration of the course: Two semesters (3rd & 4th), 106 academic hours

Course level: M (Master level)

Forms of assessment for the students’ knowledge: Marks during the course, colloquiums during the semesters, tests, final examination

What educational forms and methods are used in the course? Lectures, seminars, practical trainings

Examination after the semester: Yes

Leading lecturers: Prof. I. Mitov, Assoc. Prof. L. Sechanova and Assoc. Prof. L. Boyanova

CHAIR OF MEDICAL MICROBIOLOGY AT THE MEDICAL FACULTY – MEDICAL UNIVERSITY - SOFIA
HIGHLIGHTS OF THE COURSE: The purpose of the course in medical microbiology for students in dental medicine is to give knowledge about microorganisms that are parasites in human organisms and cause infectious processes and the associated infectious diseases; the mechanisms of transmission; innate and acquired defensive reactions of the organism, as well as the methods for their diagnostics. The course is divided into 4 sections: general microbiology, infection and immunity, special microbiology and clinical microbiology. Every section pays specific attention to the processes, the normal flora and the specificities of the infections of teeth, periodontium and oral cavity.

“General Microbiology” section concerns morphology and structure of microorganisms, their physiology (multiplication, culture methods, genetic structure and function); the impact of physical and chemical factors and the associated methods and means for sterilization and disinfection; and the antimicrobial chemotherapy.

“Infection and Immunity” section deals with the interactions between the host and the pathogenic microorganisms, the specific features of the infectious diseases, microorganisms’ factors of pathogenicity and virulence, as well as the microorganisms’ defensive mechanisms in case of infections. This section provides some general knowledge about the nature of the infectious process which is necessary for the successive prophylactic and therapeutic activities. Special attention is paid to the means for specific prophylaxis and therapy of the infectious diseases (antibody containing preparations, vaccines) and the means for immunostimulation.

“Special Microbiology” section provides information about the most significant pathogenic and opportunistic microorganisms – bacteria, viruses and fungi – their morphology and biology, their resistance in the environment and to physical and chemical factors; epidemiology, clinics and pathogenesis of the infections caused by them, mechanisms of protective immunity, means for specific prophylaxis and therapy, proper chemotherapy agents, methods for microbiological diagnosis, as well as methods for prevention and control of infections.

“Clinical Microbiology” section reviews the normal microbial flora in the oral cavity and its participation in pathological processes there (caries, periodontitis, and infections developing in the mucosa and in the deep tissues). Diseases resulting from immunopathological (autoimmune and allergic) processes are also studied here. A review of the protective mechanisms in the oral cavity is included.

DESCRIPTION OF THE COURSE: The course includes 106 academic hours:
lectures – 60 academic hours
practical training – 46 academic hours

Formation of the final mark – complex; by assessing the students’ activity during the course (marks of the current checking of knowledge and tests, a colloquium in each of the two semesters, individual written works, marks from the test and the theoretical and practical examination during the session).

Considerations for the final mark: current checking of knowledge and tests, a colloquium in each of the two semesters, individual written works, final examination (a test, written and oral examination, practical examination).

ADDITIONAL EDUCATIONAL METHODS: computer PowerPoint presentations during the practical trainings; clinical cases for discussion; multimedia; overhead projectors; laboratory technical devices in the students microbiology labs.
AIM and TASKS OF THE EDUCATIONAL PLAN: To acquaint the dental medicine students with the pathogenic and opportunistic (normal flora and saprophytes) microorganisms and the infections caused by them. Special attention is paid to the infections in the oral cavity. The educational plan aims to provide the students with knowledge on the principles of infections origin and development and the host defensive reactions. The course provides knowledge about the principles, methods and measures for prophylaxis and treatment of the infectious processes and diseases: vaccines, antibody-containing preparations, immunostimulators, antibiotics and antiviral agents; methods and agents for sterilization and disinfection. A significant goal for the course is to educate on the algorithm and methods for microbiology diagnostics, incl. specimen collection and interpretation of the results.

TASKS FOR THE PRACTICAL TRAINING:
Rules towards aseptic work in the microbiology lab, medical centers and hospitals. Rules and tools for collection, transportation and storage of specimens for microbiology testing.
- Operation with immersion oil microscope.
- Preparation of smears for microscoping.
- Simple staining methods.
- Complex staining methods.
- Stages of the microbiology testing – inoculation, isolation of pure cultures, identification.
- Preparation, reading, and interpretation of antibiograms.
- Performing basic immunological diagnostic reactions.
- Principles of preparation of disinfection solutions and rules towards the application of disinfectants and antiseptics.
- Introduction to the stages of the microbiology diagnostics for some of the major causative agents of infectious diseases.

RECOMMENDED BIBLIOGRAPHY:
- Hnibook in microbiology – edited by G. Kaprelyan and Y. Docheva

SYNOPSIS: attached
LECTURES IN MEDICAL MICROBIOLOGY FOR STUDENTS IN DENTAL MEDICINE

Winter semester


LECTION 3. Bacterial cell structure – flagella, fimbriae, cytoplasm and cytoplasm structures, ribosomes, nucleoid, spores.


LECTION 8. Antimicrobial chemotherapy: definition, principles of antimicrobial chemotherapy, requirements for antimicrobial agents, generic and trade names, spectrum of activity. Antibacterial chemotherapy products and mechanisms of their action.


LECTION 14. Immunopathology. Innate and acquired immunity deficiency. Medicine (antibiotics, etc) and bioproducts (serums, vaccines) induced allergy.

LECTURES IN MEDICAL MICROBIOLOGY
FOR STUDENTS IN DENTAL MEDICINE
Summer semester


Excercise 4 Physiology of bacteria. Growth and reproduction. Distribution of bacteria in the environment. Impact of physical and chemical agents on microorganisms.

Excercise 5 Test examination: Physiology of bacteria. Antimicrobial chemotherapy. Laboratory methods for accessing the susceptibility of bacteria to antimicrobial agents.

Excercise 6 **COLLOQUIUM**


**SUMMER SEMESTER**

Excercise 1 Basic principles of microbiological diagnostics. Microbiological diagnosis of Staphylococcal infections.

Excercise 2 Microbiological diagnosis of Streptococcal infections. Microbiological diagnosis of diseases, caused by *Neisseria*.

Excercise 3 Test examination: cocci. Family *Enterobacteriaceae*. Microbiological diagnosis of diseases, caused by bacteria from Genera *Escherichia* and *Klebsiella*.

Excercise 4 Microbiological diagnosis of diseases caused by bacteria from Genus *Salmonella* of Family *Enterobacteriaceae*.

Excercise 5 Microbiological diagnosis of bacterial dysentery. Microbiological diagnosis of diseases, caused by bacteria from Genus *Proteus* and Genus *Yersinia*.
Excercise 6 Microbiological diagnosis of cholera. Microbiological diagnosis of diseases, caused by bacteria from Family *Pseudomonadaceae*. Microflora in the environment.

Excercise 7 Microbiological diagnosis of diphtheria. Microbiological diagnosis of pertussis and parapertussis.

Excercise 8 Microbiological diagnosis of tuberculosis. Microbiological diagnosis of actinomycosis. Microbiological diagnosis of candidiasis.

Excercise 9 Microbiological diagnosis of anthrax. Microbiological diagnosis of anaerobic infections, caused by Genus *Clostridium*.

Excercise 10 **COLLOQUIUM**

Excercise 11 Family *Rickettsiaceae*. Family *Chlamydiaceae*. Viruses – basic characteristics, taxonomy, principles of virology diagnostics, taxonomy, principles of virology diagnostics.

Excercise 12 Family *Picornaviridae*. Family *Reoviridae*.

Excercise 13 Family *Ortomyxoviridae*. Family *Paramyxoviridae*. Family *Togaviridae*.


Excercise 15 Normal microbial flora of the oral cavity and its significance for development of dental diseases. Microbiological examinations in cases of dental diseases.
EXAMINATION SYNOPSIS IN MEDICAL MICROBIOLOGY
FOR STUDENTS IN DENTAL MEDICINE

I. GENERAL MICROBIOLOGY
2. Classification and nomenclature of viruses.
4. Bacterial ultrastructure - flagella, axial filaments, pili.
5. Bacterial ultrastructure – capsule, glycocalyx.
10. Morphology and structure of fungi.
15. Impact of chemical factors on microorganisms. Disinfection, disinfectants and antiseptic agents; mechanism of action and usage.
16. Impact and mechanism of action of different physical factors on microorganisms.
17. Impact of physical factors on microorganisms – sterilization, methods of sterilization and usage.
22. Antimicrobial chemotherapy. Antibacterial agents – groups according their spectrum, activity and molecular mechanisms.

II. INFECTION AND IMMUNITY
26. Infection. The role of microorganisms in infection. Infectivity, pathogenicity, virulence and contagiousness.
27. Infection. Pathogenicity and virulence factors of microorganisms.
28. Infection. Role of host, environment and social factors in infection. Reservoirs and sources of infections; mechanisms of transmission.
30. Immunity – definition, general characteristics, and types of immunity.
32. Natural resistance against infection. Humoral (chemical) defenses and factors. Phagocytosis and inflammation.
33. Acquired immunity. Types and forms of acquired immunity.
34. Antigens – definition and general characteristics. Antigen structure of bacteria.
36. Immune system – organs and cells of immune system.
38. Protective mechanisms against bacterial, fungal and viral infections.
39. Antigen-antibody reaction – mechanism and general characteristics.
40. Agglutination.
41. Precipitation. Toxin neutralization reaction.
42. Complementary-dependent reactions.
43. Immune reactions with labeled antibodies.
44. Immunopathology. Hypersensitivity reactions (allergies).
46. Immunoprophylaxis and immunotherapy. Vaccines.
47. Immunoprophylaxis and immunotherapy. Immune sera and antibody-containing preparations. Immunostimulators and immunomodulators.

III. SPECIAL MICROBIOLOGY
49. Genus Streptococcus. Group A streptococci (Streptococcus pyogenes).
50. Streptococcus pneumoniae.
51. Streptococci part of the normal human flora. Streptococcus mutans etc. Genus Enterococcus.
52. Neisseria meningitidis.
53. Neisseria gonorrhoeae.
55. Genus Salmonella.
56. Genus Shigella.
57. Genera Proteus, Providencia, Morganella; Klebsiella, Enterobacter and Serratia (K-E-S group).
59. Vibrio cholerae.
60. Haemophilus influenzae.
61. Bordetella pertussis.
62. Francisella tularensis.
63. Family Legionellaceae.
64. Genus Pseudomonas.
68. Anaerobic non-spore forming bacteria.
69. Genus Actinomyces.
70. Genus *Bacillus*. *B. anthracis*.
71. Genus *Clostridium*. *C. tetani*.
72. Anaerobic spore-forming clostridia causing gas gangrene.
73. Genus *Clostridium*. *Clostridium botulinum*. *Clostridium difficile*.
75. Genus *Borrelia*. Causative agents of Lyme disease (*Borrelia burgdorferi* etc.).
76. Genus *Leptospira*.
77. Genus *Campylobacter*. Genus *Helicobacter*.
80. Genus *Rickettsia*, Genus *Coxiella*.
81. Pathogenic fungi.
82. Picornaviruses (Family *Picornaviridae*). *Human polioviruses*. *Coxackie* - and *ECHOViruses*.
83. Orthomyxoviruses (Family *Orthomyxoviridae*). *Influenzavirus*.
84. Paramyxoviruses (Family *Paramyxoviridae*). *Parainfluenza viruses*. Virus of parotitis (*Virus parotitidis*). Virus of measles (*Morphivirus morbillorum*).
85. Reoviruses (Family *Reoviridae*). Rotaviruses (Genus *Rotavirus*).
86. *Rubella virus*.
87. Rhabdoviruses (Family *Rhabdoviridae*). *Rabies virus*.
88. Retroviruses (Family *Retroviridae*). *HIV-1* and *HIV-2*.
89. Herpesviruses (Family *Herpesviridae*). *Human herpesvirus 1, 2; (Virus herpes simplex)*. Varicella-zoster (*Human herpesvirus 3, Herpesvirus varicella*).
90. Hepatitis viruses (*Human hepatitis A, B, C, D, E* and *G viruses*).
91. Prions.
92. Microorganisms in the environment.
93. Microbial flora of human body in health and disease.
94. Microbial flora in the oral cavity.
95. Ethiological factors and pathogenesis mechanisms in pathological processes in oral cavity and teeth.
96. Pathological processes in the oral cavity caused by microorganisms. Caries.
97. Pathological processes in the oral cavity caused by microorganisms. Diseases of dental pulp and periapical tissues.
98. Pathological processes in the oral cavity caused by microorganisms. Periodontal diseases.
100. Pathological processes in the oral cavity caused by microorganisms. Focal infection. Hypersensitivity and its clinical significance in dental medicine.
101. Protective mechanisms in the oral cavity. Specificities of the natural resistance and acquired immunity in the oral cavity.
PRACTICAL EXAMINATION

4. Smear preparation and staining by Peshkov method. Technique, observation and examination of the preparations.
5. Simple nutrient media. Types, composition and application. Observation (characteristic) of bacterial growth in broth and agar media.
6. Special (enriched) nutrient media. Types, composition and application. Observation (characteristic) of bacterial growth in broth and agar media.
9. Methods and nutrient media for cultivation of anaerobe and microaerophile bacteria. Reading of the growth of anaerobe bacteria.
11. Quantitative methods for the determination of bacterial growth: enumeration with optical standard and determination of microbial count on a solid medium.
17. Slide agglutination (direct agglutination): principle, technique and reading of the results.
22. Titration of hemolytic serum – application, principle, technique and reading of the results.
24. ELISA (Enzyme-linked immunosorbent assay) – basic principle, reading and interpretation of results, application. Immunofluorescence – direct and indirect immunofluorescence, application.
25. Virus hemagglutination and hemagglutination inhibition (HAI) reactions - application, principle, technique and reading of the results.
27. Antibacterial vaccines - characterization, application.
28. Antiviral vaccines – characterization, application.
30. Microbiological testing of microbial flora – specimens collection and transportation, stages of the examination, reading the results.
31. Tests for detection and pathogenicity of *Staphylococcus* spp. – reading and interpretation of results.
32. Tests for identification of *Streptococcus* spp. and *Enterococcus* spp.
34. Sanitary-microbiological examination of potable water, soil, air, and food.
35. Specimen collection from teeth and oral cavity for microbiological examination. Principle of the examination and reading the results.