Course name: BASICS OF MEDICAL MICROBIOLOGY AND PARASITOLOGY
COURSE AIMS

Course aims: To learn the principle biological features of microorganisms that cause human infections, their pathogenic characteristics, distribution and resistance to environmental conditions as well as the pathways of their interhuman transmission, including susceptibility to different antimicrobial agents and the mechanisms of human defence against infection. Students will also learn about the types of vaccines accompanying certain microorganisms.

Course goal: To learn the basic groups of antimicrobial agents, spectrum of their activity and mechanisms of resistance to antimicrobial agents. At the end of the course, the students themselves will be able to identify the most common microorganisms, based on the microscopic appearance or other characteristics, read the susceptibility test and define the transmission pathway, as well as the principles of human defence against specific microorganisms. Also, students will be able to collect nose and throat swab and inoculate biological materials on microbiological media.

TEACHING UNITS AND TOTAL HOURS

The course has three teaching units: 1) **Bacteriology** (9 hours of lectures, 8 hours of seminars and 20 hours of practicals); 2) **Mycology and Parasitology** (5 hours of lectures, 6 hours of seminars and 10 hours of practicals) and 3) **Virology** (5 hours of lectures, 10 hours of seminars and 7 hours of practicals). The total course hours are 80 hours (19 hours of lectures, 24 hours of seminars and 37 hours of practicals).

Teaching and thematic units are as follows:

BACTERIOLOGY

Lecture B1 (4h): Introduction to medical microbiology. Bacterial structure, physiology and genetics. Pathogenesis of bacterial diseases. Bacterial antigens and vaccines.

Practical B1 (4h): Introduction to microbiological laboratory and the basics of safe laboratory work. Laboratory-acquired infections. Microscopic examination of principal bacterial shapes. Differential staining in bacteriology. Cultivation of bacteria. Media types.

Lecture B2 (2h): Antibacterial agents. Antimicrobial resistance in bacteria.

Seminar B1 (2h): Genera *Streptococcus, Staphylococcus, Enterococcus.*

Practical B2 (4h): Performing, reading and interpreting the antibiogram (disk diffusion method, broth dilution, agar dilution, E-test). Collecting and inoculating throat swab. Principles of isolation and identification of pyogenic cocci.

Seminar B2 (2h): Characteristics of bacteria from the family *Enterobacteriaceae.*

Practical B3 (4h): Macroscopic and biochemical identification of *Enterobacteriaceae*. Serotyping. Serological testing (Widal, agglutination). Characteristics of genera *Bordetella, Brucella*.

Seminar B3 (2h): *Neisseria, Moraxella,Haemophilus ;*Genera *Bordetella, Brucella*.

Seminar B4(2h): Gram-negative nonfermenting bacteria – genera *Pseudomonas, Acinetobacter, Stenotrophomonas.*

Seminar B5(2h): Gram-negative, curved, rod-shaped bacteria – genera *Vibrio, Helicobacter, Campylobacter*. Anaerobic bacteria – genera *Clostridium, Actinomyces*; family – *Bacteroideaceae.*

Practical B4 (4h): *Pseudomonas* on OA, resistant strains. *Campylobacter* - cultivation and microscopy. *Vibrio* – culture. Helicobacter in tissue sample. Collecting and transporting specimen for cultivation of anaerobic bacteria. Principles of anaerobic cultivation. Microscopic view – *Clostridium, Actinomyces, Bacteroides, Fusobacterium. Neisseria spp., Haemophilus*.

Lecture B3 (3h): Gram-negative spiral bacteria – family *Spirochaetaceae*. Cell wall-defective bacteria – family *Mycoplasmataceae*. Obligate intracellular bacteria: *Rickettsiaceae, Chlamydiaceae*

Seminar B6 (2h): Genera – *Bacillus, Corynebacterium, Listeria, Legionella*. Acido-resistant bacteria – genera *Mycobacterium* and *Nocardia*.

Practical B5 (4h): *B. anthracis* – presentation of spores and capsule, *B. subtillis* – spores cultivation. *Corynebacterium* – cultivation, staining and microscopy. *Listeria* – culture, microscopy. Acid-fast staining (Ziehl-Nielsen). Specimen collecting, transporting and processing for isolation of mycobacteriae. Cultivation of mycobacteria. Test of resistance to tuberculostatics. *Nocardia* – microscopy of stained specimen. Serologic tests for *T. pallidum, Legionella, Mycoplasma, Ureaplasma* – culture.

Lecture B4 (1h): Multiresistant bacteria

MYCOLOGY

Lecture M (2h): Introduction to mycology. Morphology and reproduction of the fungi. Fungal diseases - pathogenesis. Antifungal agents.

Seminar M (2h): Medically important fungi.

Practical M (2h): Yeasts and moulds – macro and micromorphology. Principles of isolation and identification od medically important yeasts and moulds. Serological diagnosis of mycoses. Diagnosis of dermatomycosis.

PARASITOLOGY

Lecture P (3h): Introduction to medical parasitology. Medical protozoology. Blood and tissue protozoa - genera: *Toxoplasma, Plasmodium, Leishmania*.

Seminar P1 (2h): Protozoa of the gastrointestinal and urogenital tract – genera: *Giardia, Entamoeba, Cryptosporidium, Trichomonas.*

Practical P1 (4h): Diagnosis of toxoplasmosis, leishmaniasis and malaria. Giemsa-Romanowsky- stained biopsy specimen, thick and thin blood films. Preparing, staining and microscopy of specimen (recognition of parasitic forms). Serological diagnostic testing. Arthropods of medical importance - morphology.

Seminar P2 (2h): Cylindrical warms and tapewarms: Platyhelminthes (*Taenia, Echinococcus*), Nematodes (*Trichinella, Trichuris, Strongyloides, Enterobius, Ascaris*).

Practical P2 (4h): Diagnosis of intestinal parasitosis. Microscopy of direct wet mount, Lugol's iodine and concentration method (MIFC). Micromorphology of protozoan cysts, eggs and larval helmints. Recognition of adult forms. Graham's anal swab. Diagnosis of echinococcosis and trichinellosis.

VIROLOGY

Lecture V1 (3h): Introduction to virology. Viral chemical composition and structure. Viral antigens and hemagglutination. Viral replication. Pathogenesis of viral diseases. Viral interference and interferon. Chemoprophylaxis and therapy of viral diseases. Viral vaccines. Prions.

Seminar V1 (2h): *Parvoviridae, Papovaviridae, Adenoviridae, Poxviridae*.

Practical V1 (3h): Clinical samples in virology. Cultivation of viruses in laboratory animals. Cultivation of viruses in chicken embryo - inoculation. Cultivation of viruses in cell culture. Microscopy of cythopatic effect. Microscopy of intracellular inclusions.

Seminar V2 (2h): *Herpesviridae*. Hepatitis B, C and D.

Lecture V2 (2h): *Flaviviridae, Togaviridae, Bunyaviridae, Filoviridae, Arenaviridae*.

Practical V2 (4h): Serological methods in diagnosing viral diseases. Rapid tests and methods of molecular biology in virology.

Seminar V3 (2h): RNA viruses: *Picornaviridae* (genera *Enterovirus, Hepatovirus*), *Caliciviridae, Rhabdoviridae*.

Seminar V4 (2h): *Orthomyxoviridae, Paramyxoviridae, Coronaviridae*.

Seminar V5 (2h): *Reoviridae, Retroviridae*.

OBLIGATORY TEXTBOOK

Brooks GF, Carroll KC, Butel JS, Morse SA, Mietzner TA, eds. Jawetz, Melnick and Adelbergs Medical Microbiology. 26th ed. New York: McGraw-Hill; 2013.

USEFUL LINKS:

http://phil.cdc.gov/phil/home.asp

http://microbiology.mtsinai.on.ca/mig/index.shtml

http://www.microbelibrary.org/

STUDENTS' RESPONSABILITIES

All components of teaching are obligatory. Students are allowed to miss up to 20% of the total course hours JUSTIFIABLE, provided that ALL abscenses are compensated through a colloquium. Students must be prepared for seminars and practical work, according to the topics in the schedule. Active participants will be given extra pluses that will be added to the points achieved on written part of the exam (3 pluses = 1 point).

Unprepared seminars and practicals will be punished wih a minus and must be compensated through a colloquium, because these are condition for partial written exams and final exam. Minuses and all abscenses must be compensated through a colloquium, before gaining entry to a partial test-exam, and the entire exam.

For practical work, students need white coat, one notebook, a pencil or a pen and colored pencils. Food, drink, cigarettes or chewing gums cannot be taken in the practice room.

After work on each practical, students MUST wash hands well according to the given instructions and after that do not touch or take out working materials.

EXAM

The course Basics of Medical Microbiology and Parasitology has **written** and **practical** exam. During the course, there will be three partial test-exams. The right to participate in partial test have students who attend 5th semester in this academic year, and who did not miss any classes or were excused and compensated their abscences through a colloquium.

PARTIAL WRITTEN EXAMS

The first partial test consists of questions from Virology (40 questions – 40 minutes). The second partial test consists of questions from Bacteriology (60 questions – 60 minutes). The third partial test consists of questions from Mycology and Parasitology (30 questions – 30 minutes). The total percentage of correct answers for a passing grade is 60% in every test-exam (Virology – 24 points; Bacteriology - 36 points; Parasitology and Mycology - 18 points). When all three written partial exams are passed, they count as passed written component of the exam. Results from partial tests and points collected through active participating during the course, are valid only during the academic year in which they are achieved.

PRACTICAL EXAM

Practical exam consists of five parts, as follows:

1.description and interpretation of three microscopic slides (one of these is a parasitologic slide), made directly from patients' samples or culture (the list of slides, below).

2.making, Gram staining and interpretation of urine sediment slide.

3.reading culture from one of the microbiological media (the list of media, below)

4.reading and interpreting antimicrobial susceptibility of isolated bacteria (disk diffusion antibiotic sensitivity testing).

5.reading and interpretation of one serological reaction (agglutination, complement-fixation reaction -CF, HBV serological profile, ELISA).

The list of the microscopic slides on the practical exam

Organism	**Staining method**
Staphylococcus sp.	Gram stain
Streptococcus sp.	Gram stain
Streptococcus pneumoniae	Gram stain, methylen blue
Neisseria meningitidis	Gram stain
Neisseria gonorrhoeae	Gram stain, methylen blue
Neisseria sp.	Gram stain
Haemophilus influenzae	Gram stain
Campylobacter sp.	Gram stain
Bacteroides sp.	Gram stain
Fusobacterium sp.	Gram stain
Enterobacteriaceae	Gram stain
Klebsiella pneumoniae	India ink
Clostridium sp.	Gram stain
Clostridium tetani	Gram stain
Mycobacterium sp.	Ziehl-Neelsen
Corynebacterium diphteriae	Gram stain
Corynebacterium sp.	Gram stain
Bacillus anthracis	Gram stain, methylen blue
Candida albicans	Gram stain
Cryptococcus neoformans	India ink
Aspergillus sp.	Lactophenol
Penicillium sp.	Lactophenol
Plasmodium falciparum	Giemsa-Romanowsky
Plasmodium vivax	Giemsa-Romanowsky

Leishmania sp. (amastigotes)	Giemsa-Romanowsky
Leishmania sp. (promastigotes)	Giemsa-Romanowsky
Toxoplasma gondii	Giemsa-Romanowsky
Taenia sp.	Lugol's iodine
Ascaris lumbricoides	Lugol's iodine
Trichuris trichiura	Lugol's iodine
Enterobius vermicularis	Scotch tape preparation
Trichomonas vaginalis	Giemsa
Entamoeba histolytica (cysts)	Lugol's iodine
Entamoeba coli (cysts)	Lugol's iodine
Cryptosporidium sp.	Ziehl-Neelsen

Microbiological media with grown cultures

Media	**Organism**
Blood agar (BA)	*Streptococcus pyogenes* *Streptococcus „viridans“* *Streptococcus pneumoniae* *Streptococcus agalactiae* *Staphylococcus aureus* *Haemophilus influenzae* *Escherichia coli* *Proteus sp.*
Nutrient agar (NA)	*Pseudomonas aeruginosa* *Serratia marcescens*
SS agar	*Salmonella sp.* *Escherichia coli*
CLED agar	*Escherichia coli* *Proteus sp.* *Klebsiella sp.*
Sabouraud agar	*Candida sp.* *Cryptococcus neoformans* *Penicillium sp.* *Aspergillus sp.*

Average of two grades; written exams (40%) and practical exam (60%), will be calculated to get the final grade.