**SYLLABUS**

for the education cycle starting in the academic year 2021/2022

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| **Name of a course / module** | **Microbiology** | |
| **Name of a department where course is held** | **Department of Medical Microbiology and Nanobiomedical Engineering** | |
| **E-mail of department** | **mikrob@umb.edu.pl** | |
| **Faculty of** | Medicine with Division of Dentistry and Division of Medical Education in English | |
| **Name** **of a field of study** | **Faculty of Medicine** | |
| **Level of education** | *First degree studies, Uniform master’s degree studies* | |
| **Form of study** | full time **□** part time □ | |
| **Language of instruction** | Polish □ English □ | |
| **Type of course** | obligatory □ facultative □ | |
| **Year of study / Semester** | I □ II □ III □ IV □ V □ VI □ | 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7 □ 8 □ 10 □  11 □ 12 □ |
| **Introductory courses with preliminary requirements** |  | |
| **Number of didactic hours with specification of forms of conducting classes** | **83 h** : 20 h lectures; 53 h classes, 10 h seminars | |
| **Assumptions and aims**  **of the course** | **Aims of the course :**   * classifications of microorganisms * general characteristics of bacteria, fungi, viruses and prions * host-microbe interactions and human microflora (microbiota) * etiology, pathogenesis, and epidemiology of infectious diseases * microbial infections of the human body * microbiological diagnostic procedures * empirical and targeted antimicrobial therapy * microbial growth control: disinfection, sterilization, antisepsis, etc. * hospital infections   At the end of the course, the students should be able to:   * classify and describe the biological properties of microorganisms * list the pathogenic microorganisms and their general characteristics and methods of identification * explain the mechanisms of microbial pathogenesis * use the correct method of collection, storage, and transport of clinical specimens for microbiological investigations * interpret microbiology laboratory tests for the diagnosis of infectious diseases * select suitable agents for antimicrobial therapy * apply the methods of sterilization, disinfection, and antisepsis to prevent and control infections | |
| **Didactic methods** | *Providing knowledge in a form of a lecture, other practical classes* | |
| **Full name of the person conducting the course** | *employed scientific and teaching staff* | |
| **Full name of the person responsible for teaching** | Prof. dr hab. Robert Bucki | |

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| **Symbol and number of learning outcomes according to the teaching standards and other learning outcomes** | **Description of directional learning outcomes** | **Form of classes** | **Verification methods for achieving intended learning outcomes** |
| **Knowledge** | | | |
| C.W11. | genetic mechanisms of drug resistance developed by microorganisms | lecture  classes | **Classes** – written (test) and practical  **Final exam**: theoretical (test) |
| C.W12. | how to classify microorganisms, such as pathogenic and physiological ones; | lecture  classes |
| C.W13. | epidemiology of transmission of viruses, bacteria, fungi, and parasites,  and geographical range of their occurrence; | lecture  classes |
| C.W14. | effect of abiotic and biotic environmental factors (viruses, bacteria) on the human organism and population, the ways of their getting into the human organism; effects of chemical and biological threats to the human organism, principles of prophylaxis; | lecture  classes |  |
| C.W15. | invasive forms or developmental stages of chosen parasitic fungi, protozoa, helminths, and arthropods, and geographical range of their occurrence; | lecture  classes |  |
| C.W16. | host-parasite system and basic symptoms of diseases caused by parasites; | lecture  classes |  |
| C.W17. | symptoms of iatrogenic infections, ways of dissemination, pathogens responsible for changes in particular organs; | lecture  classes |  |
| C.W18. | basics of microbiological and parasitologic diagnostics; | lecture  classes |  |
| C.W19. | basics of disinfection, sterilization, and aseptic procedures; | lecture  classes |  |
| C.W39. | the drug-resistance problem, multidrug-resistance; | lecture  classes |  |
| C.W10. | determine benefits and risks associated with the presence of genetically modified organisms (GMO) in ecosystem | lecture  classes |  |
| **Skills** | | | |
| C.U6. | estimating environmental threats; using basic methods to detect harmful factors (biological and chemical) in the biosphere; | classes |  |
| C.U7. | diagnosing the typical human parasites based on their structure,  life cycles and pathologic symptoms; | classes |
| C.U9. | making a preparation and diagnosing pathogens with a microscope; | classes |
| C.U10. | interpreting microbiological test results; | classes |
| C.U15. | designing a rational chemotherapeutic scheme of infections: both empirical and guided scheme; | classes |  |
| **Social competence** | | | |
| K1 | He /She recognizes his/her own diagnostic and therapeutic limitations, educational needs, planning of educational activity | lecture  classes | **Continuous assessment by the teacher** |
| K2 | He /She is able to work in a team of professionals, in a multicultural and multinational environment | lecture  classes |
| K3 | He /She implements the principles of professional camaraderie and cooperation with representatives of other professionals in the range of health care | lecture  classes |
| K4 | He /She observes doctor-patient privilege; and patient rights | lecture  classes |  |

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| **ECTS points** | *9 (incl. Parazytology)* | | |
| **Student Workload** | | | |
| **Form of activity** | | **Number of hours to complete the activity** | |
| **Classes that require the participation of a teacher** | | | |
| 1. Realization of the course: lectures (according to the curriculum ) | | 20 | |
| 1. Realization of the course: classes (according to the curriculum ) | | 53 | |
| 1. Realization of the course: seminars; (according to the curriculum) | | 10 | |
| 1. Realization of the course: electives | |  | |
| 1. Participation in consultation | |  | |
|  | | Total hours: 83 | |
| **Student self-study**  *1 punkt ECTS oznacza 25-30 godzin pracy studenta w różnych formach, takich jak np.:* | | | |
| 1. Preparation for the theoretical and practical classes (realization of projects, documentation, case description etc.) | | |  |
| 1. Preparation for tests/credits | | |  |
| 1. Preparation for an exam/final test-credit | | |  |
|  | | | Total hours: |

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| **Course contents:** *proszę wpisać hasłowo tematykę poszczególnych zajęć, pamiętając, aby przekładała się ona na zamierzone efekty kształcenia* | |
| **Learning outcomes**  **(symbol and number)** | **Topics** |
| C.W10, C.W12, C.W14, C.W16, | Introduction to medical microbiology. Classifications and characteristics of cellular microorganisms (bacteria, fungi, protists) and acellular microorganisms viruses, virus-like organisms (viroids), and prions. Prokaryotic and eukaryotic microorganisms. |
| C.W16, C.W17, C.W18, | Bacterial cell structures and functions. |
| C.W11, C.W13, C.W14, | Bacterial metabolism and genetics. |
| C.W12, C.W13, C.W14, C.W16, C.W17 | Classification and characterization of Gram-positive bacteria |
| C.W12, C.W13, C.W14, C.W16, C.W17 | Classification and characterization of Gram-negative bacteria |
| C.W12, C.W13, C.W14, C.W16, C.W17 | Classification and characterization of anaerobic and atypical bacteria |
| C.W12, C.W13, C.W14, C.W15, C.W16, C.W17 | Fungal classification, structure, and reproductive characteristics.  Medically important Fungi and classification of human mycoses.  Mycotoxins and mycotoxicosis. |
| C.W12, C.W13, C.W14, C.W16, C.W17 | Medically important DNA and RNA viruses: classification and characteristics.  Viral immunopathogenesis and epidemiology. Antiviral therapy. Oncogenic viruses. |
| C.W11, C.W14, C.W39 | Antimicrobial chemotherapy: mains groups of antibacterial, antifungal, and antiviral drugs, their mechanisms of action and spectrum, pK/pD parameters, and antimicrobial testing methods. Mechanisms of resistance to antibacterial agents: emergence and spread of antibiotic-resistant pathogens (alert pathogens). Rationale antimicrobial therapy. |
| C.W10, C.W12, C.W13, C.W14, C.W15, C.W16, C.W17 | Microorganisms (bacteria, fungi, viruses) and mechanisms of pathogenesis or immunopathogenesis. Mechanisms of bacterial pathogenesis: colonization, adhesion, and invasion/inflammation. Bacterial toxins: exotoxins, endotoxins (LPS, LOS), and other virulence factors. |
| C.W12, C.W18  C.U9 | Theoretical part: Organization lessons. Safety precautions in the clinical microbiology laboratory. Microscopy and various types of microscopes. Practical part: Study of the cell morphology under the light microscope |
| C.W12, C.W13, C.W15, C.W18,  C.U7, C.U9 | Theoretical part: Introduction to medical microbiology. Classifications and characteristics of microorganisms (bacteria, fungi, protists, viruses, viroids and prions). Prokaryotic and eukaryotic microorganisms. Bacterial cell structures and functions are essential (cell wall, cytoplasmic membrane) and nonessential (capsules, slime, flagella, fimbriae, spores and granules).  Practical part: Morphology and physiology of bacteria: methods of study  1. Methods of smear preparations of cultured material on slides  1.1. Procedure: Prepare a heat-fixed smear  2. Methods of bacterial staining  2.1. Simple (direct) - (methylene blue) and negative (nigrosine) staining  2.2. Procedure: Staining according to Gram (Gram stain) and evaluating the morphology of bacterial cells under the microscope  3. Staining of microbial structures (special stains)  3.1. Procedure: Neisser´s stain (Ernst-Babes bodies)  3.2. Procedure: Dorner´s stain (spores)  3.3. Procedure: Maneval´s stain (capsules) |
| C.W12, C.W18,  C.U6, C.U7, C.U9, C.U10, | Theoretical part: Essential bacterial cell structures and functions: the genome and bacterial genetics: chromosome and extrachromosomal genetic elements (mobilome: plasmids, transposons, bacteriophages, etc.). Bacterial growth and cell division. Bacterial metabolisms. Classification and characteristics of aerobic bacteria.  Practical part: Morphology and physiology of bacteria: methods of study  1. Bacterial cultures  1.1. Culture media  1.2. Media and methods for isolation and cultivation of aerobic, anaerobic, and microaerophilic bacteria  2. Colony and cultural morphology |
| C.W12, C.W18,  C.U6, C.U7, C.U9, C.U10, | TEST 1: General Microbiology  Theoretical part: Essential bacterial cell structures and functions: the genome and bacterial genetics: chromosome and extrachromosomal genetic elements (plasmids, transposons, bacteriophages). Bacterial growth and cell division. Bacterial metabolisms. Classification and characteristics of microaerophilic and anaerobic bacteria.  Practical part: Morphology and physiology of bacteria: methods of study  1. Media and methods (procedures) for isolation, cultivation, and identification of anaerobic and microaerophilic bacteria  2. Identification methods  2.1. Conventional tests  2.2. Colony and cultural morphology  2.3. Typing microorganisms  2.4. Physiological (biochemical) characteristic  2.5. Modern identification methods (genetic and mass spectrometry methods) |
| C.W12, C.W14, C.W18  C.U6, C.U7, C.U9, C.U10 | Theoretical part: Classifications and characteristics of anaerobic Gram+ bacteria *(Staphylococcus, Streptococcus, Enterococcus, Bacillus, Corynebacterium, Listeria*, *Clostridium, Cutibacterium, Actinomyces*, *Finegoldia*, etc.)  Practical part: Culture and identification methods |
| C.W12, C.W14, C.W18  C.U6, C.U7, C.U9, C.U10 | Theoretical part: Classifications and characteristics of Gram-negative bacteria (*Enterobacterales*, *Pseudomonas, Neisseria, Haemophilus, Bordetella*, *Bacteroides, Fusibacterium*, *Prevotella*, etc.)  Practical part: Culture and identification methods |
| C.W12, C.W14, C.W15, C.W18  C.U6, C.U7, C.U9, C.U10 | Theoretical part: Fungal classification, structure, and reproductive characteristics. Medical important Fungi and classification of human mycoses. Mycotoxins and mycotoxicoses.  Practical part:   1. Culture and identification of yeasts: *Candida, Cryptococcus, Saccharomyces* and other yeasts 2. Culture and identification of molds: *Aspergillus, Penicillium,* and other molds |
| C.W18, C.W39,  C.U10, C.U15 | Theoretical part: Microbial growth control and measures: chemotherapy and chemoprophylaxis. Empiric chemotherapy. Antibacterial agents.  Practical part: Control of microbial growth in human diseases:   1. Susceptibility test methods:   1.1. Dilution (MIC, MBC, MBQ) and disk diffusion methods  1.2. Antibiotic gradient diffusion method (Etest)  1.3. Breakpoint susceptibility tests  2. Interpretation and reporting of results (EUCAST/CLSI guidelines) |
| C.W11, C.W18, C.W39,  C.U10, C.U15 | Theoretical part: Review of antibacterial chemotherapeutics: mechanisms of action,  spectrum and activity. Bacterial mechanisms of resistance to antibacterial agents.  Practical part:   1. Methods of drug resistance measurement and interpretation of the results    1. β-lactamases and methods of study: ESBL, AmpC, NDM, KPC, and others    2. Study methods of resistance to vancomycin among staphylococci (VISA, VRSA) and enterococci (VRE)    3. MLSB (*macrolide-lincomycin-streptogramin* B) type of resistance    4. HLAR (*high-level aminoglycoside resistant*) type of resistance among enterococci   2. Susceptibility test methods:  2.1. Fastidious bacteria  2.2. Special phenotypic methods for detecting antibacterial resistance  2.3. Assessment of resistance of *Staphylococcus* to methicillin (MRSA, MRCNS)  2.4. Assessment of resistance to penicillin or/and ampicillin among *Streptococcus pneumoniae* (PISP; PRSP),  *Haemophilus* spp., *Neisseria* spp., *Moraxella catarrhalis* and others  3. Alert pathogens |
| C.W13, C.W14, C.W19,  C.U6, C.U10 | TEST 2: Classification and characteristics of medically important bacteria and fungi  Theoretical and practical part: Control of microbial growth and measures:  1. Physical agents of disinfection and sterilization  2. Chemical agents of disinfection and sterilization  3. Monitoring and control of the sterilization process  4. Sterilants and levels of disinfectants  5. Infection control epidemiology (hospital infections) and clinical microbiology   * 1. 5.1. Microbiologic control of air and surfaces   2. 5.2. Decontamination   3. 5.3. Aseptic and antiseptic procedures   4. 5.3.1. Antiseptic agents   5.4. Hand washing |
| C.W18,  C.U7, C.U9, C.U10 | Theoretical and practical part: Microbiology specimen collection and transport.  Diagnosis of infectious diseases (culture methods, serologic and molecular tests) |
| C.W13, C.W14, C.W15, C.W16, C.W17, C.W18, C.W39  C.U6, C.U7, C.U9, C.U10  C.U6, C.U7, C.U9, C.U10, C.U15 | TEST 3: Antimicrobial therapy (antibacterial, antifungal, and antiviral) and microbial growth control (disinfection, sterilization, decontamination, antisepsis)  Theoretical and practical part :  1. Urinary tract infections (UTI)  1.1. Characteristics of uropathogens: *Escherichia coli* and some other Gram-negative rods, staphylococci, enterococci, and *Candida* spp.  1.2. Microbiological and immunological methods for diagnosis of UTIs  2. Causative agents pathogenesis and immunodiagnosis of sexually transmitted infections (STIs), congenital peri- and postnatal infections  2.1. Non-specific and specific tests for diagnosis of *Treponema palladium* infection (syphilis).  3. Gastrointestinal tract infections (GTI) :  3.1. Main microbial pathogens, pathogenesis, and immunity: *Escherichia coli, Salmonella, Shigella, Yersinia, Campylobacter, Helicobacter pylori, Clostridioides difficile, Listeria monocytogenes, etc.*  3.2. Microbiological, immunological, and molecular methods for diagnosis of GTIs  • pathogen, antigen and/or toxin detection in stool specimens  • serology |
| C.W13, C.W14, C.W15, C.W16, C.W17, C.W18, C.W39  C.U6, C.U7, C.U9, C.U10  C.U6, C.U7, C.U9, C.U10, C.U15 | Theoretical part: Microbial agents (bacteria, viruses, and fungi) and immunopathogenesis of purulent and aseptic meningitis. Immunodiagnostic of infectious diseases.  Practical part:   1. Laboratory diagnosis of purulent and aseptic meningitis   • Microscopy and culture of cerebrospinal fluid (CSF)  • Specific antigen or antibody detection in CSF or and serum  • Nucleic acid amplification assays  Respiratory tract infections (RTIs): characteristics of some pathogens of upper (URTIs)  and lower respiratory tract infections (LRTIs). Community and hospital LRTIs.   1. Microbiological and immunological methods for diagnosis of RTIs   • Cultures and typical microbial agents  • *Streptococcus pneumoniae, Haemophilus, Moraxella and* others  • Pathogens and diagnosis of atypical pneumonia:  • viruses: *Influenza A virus*, RSV, *Parainfluenzavirus*  • bacteria: *Chlamydia/Chlamydophila, Rickettsia, Anaplasma, Coxiella, Mycosplasma, Legionella, etc.* |
| C.W13, C.W14, C.W15, C.W16, C.W17, C.W18, C.W39  C.U6, C.U7, C.U9, C.U10  C.U6, C.U7, C.U9, C.U10, C.U15 | Theoretical part: Microorganisms and mechanisms of pathogenesis.  Specific microbial adherence mechanisms. Colonization and infection. Bacteria and biofilms.  Commensal (microbiota) and pathogenic microorganisms in humans. Opportunistic pathogens. Exotoxins and endotoxins (LPS, LOS) and other virulence factors. Skin and soft tissue infections. Bloodstream infections: sepsis, septic and toxic shocks, *endocarditis infectiosa,* and others.  Practical part: Major agents in blood and hospital infections and diagnostic methods:  • classic (culture) and modern methods for detecting antigens and/or nucleic acids for diagnosis of infectious diseases and for epidemiological analysis. |
|  | Practical credit |

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| **Obligatory textbook:** *(1-2 pozycje)* |
| **Basic :**  1. Murray P.R., Rosenthal K.S., Pfaller M.A.  **Medical Microbiology.** 9th Edition. Elsevier 2021  2. Richard Goering, Hazel Dockrell, Mark Zuckerman, Peter Chiodini  **Mims' Medical Microbiology and Immunology,** Elsevier, 6th Edition, 2018 |
| **Optional textbook:** *(1-2 pozycje)* |
| **Optional :**  1. Karen C. Carroll, Janet S. Butel, Stephen A. Morse  **Jawetz, Melnick, & Adelberg's** **Medical Microbiology**. 28th Edition, Lange Medical Books/McGraw-Hill, 2019.  2. Murray P.R., Rosenthal K.S.  **Review of Medical Microbiology**. Elsevier, 2005 |

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| **Criteria for assessing the achieved learning outcomes and the form and conditions for receiving credit:** *Należy określić w szczególności: zasady dopuszczenia do egzaminu, zwalniania z egzaminu, sposób i warunki zaliczenia zajęć, łącznie z określeniem zasad zaliczania nieobecności oraz określeniem liczby godzin nieobecności kwalifikujących do niezaliczenia przedmiotu oraz możliwości i formy wyrównywania zaległości* |
| **Student Responsibilities**   1. **Participation in lectures and classes is obligatory**. 2. Absence (even justified) on more than four classes labs and/or more than three lectures and results in non-admission to the examination session. 3. **Students must study safety precautions and hand hygiene at work during the classes**. 4. **The course** **includes four tests** in blocks of topics **and the practical exam** (exemption from the practical exam is possible). 5. **The final exam** (test) is in the summer examination session, and only **students with credit for microbiology classes and who pass the practical exam** **are admitted to this exam (**there are no exemptions from the final exam).   Grading scale:  <60% - Failed (2)  60%-69% - Satisfactory (3)  70%-79% - Fairly Good (3+)  80%-87% - Good (4)  88%-93% - Better Than Good (4+)  ≥94% - Very Good (5) |
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*(date and signature of the person preparing the syllabus)*

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*(date and signature of the Head of the and (course coordinator)*

*Department where the course is held)*