SYLLABUS

for the education cycle starting in the academic year 2024/2025

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 :** • Classification of microorganisms. • General characteristics of bacteria, fungi, viruses and prions. • Host-microbe interactions and human microbiota (microflora). • Etiology, pathogenesis, and epidemiology of infectious diseases. • Diagnostic techniques in microbiology. • Antimicrobial agents and 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. • Identify pathogenic microorganisms, summarizing their general properties and diagnostic techniques. • Describe the mechanisms underlying microbial pathogenesis. • Follow correct procedures for collection, storage, and transport of clinical specimens for microbiological diagnosis. • Analyze and interpret microbiological laboratory test results for diagnosing infectious diseases. • Select suitable agents for antimicrobial therapy. • Implement sterilization, disinfection, and antiseptic procedures as measures of infection control.	
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	

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		
CW9	knows the genetic mechanisms of acquisition of drug resistance by microorganisms and cancer cells and their relation to the necessity of individualisation of pharmacotherapy	lectures classes seminars	Summarising methods: Final assessment - practical and written credit Formative methods: Exercises - written and practical credit
CW10	knows and understands microorganisms including pathogenic and constituting the human microbiome and human invasive forms or developmental stages of selected parasites	lectures classes seminars	
CW11	Knows the epidemiology of infections caused by viruses, bacteria fungi and parasitic infections including the geographical range of their occurrence	lectures classes seminars	
CW12	knows the pathogenesis and pathophysiology of infections and infestations and the impact of pathogenic agents such as viruses, bacteria, fungi, prions and parasites on the human body and population, including the ways of their impact, the consequences of exposure to them and the principles of prevention	lectures classes seminars	

CW14	knows the aetiology, pathogenesis, pathophysiology, ways of transmission, forms and prevention of iatrogenic infections	lectures classes seminars	
CW15	knows and understands the methods used in microbiological diagnostics (indications, principles of performance, interpretation of the result)	lectures classes seminars	
CW16	knows and understands the principles of diagnosis of infectious, allergic, autoimmune and neoplastic diseases and blood diseases based on antigen-antibody reaction	lectures classes seminars	
CW17	knows the basics of disinfection, sterilization and aseptic procedures	lectures classes seminars	
CW32	understands the problem of drug resistance, including multidrug resistance, and the principles of rational antibiotic therapy	lectures classes seminars	
Skills			
CU5	is able to recognise pathogens under the microscope	classes	Summarising methods: Practical assessment credit Formative methods: -observation of student work -assessment of preparation for classes
CU6	interprets the results of microbiological examinations	classes seminars	
CU10	designs a rational chemotherapy regimen for infections - empirical and targeted	classes seminars	
CU12	is able to search for reliable information on medicinal products, with particular reference to the characteristics of medicinal products (SmPC) and databases	classes seminars	
Social competence			
K4	notices and recognises their own limitations and takes a self-assessment of deficits and educational needs	lectures classes seminars	Continuous assessment by the teacher
K7	uses objective sources of information	lectures classes seminars	
K8	formulates conclusions from own measurements or observations	lectures classes seminars	
K10	formulates opinions on various aspects of professional activity	lectures classes seminars	

ECTS points	*7*

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
2. Realization of the course: classes (according to the curriculum)	53
3. Realization of the course: seminars; (according to the curriculum)	10
4. Realization of the course: electives	
5. Participation in consultation	2,5
	Total hours: 85,5
Student self-study.:	
1. Preparation for the theoretical and practical classes (realization of projects, documentation, case description etc.)	20
2. Preparation for tests/credits	40
3. Preparation for an exam/final test-credit	30
	Total hours: 90

Course contents:	
Learning outcomes (symbol and number)	**Topics**
CW10, CW11, CW12 K4, K8	Lecture: Introduction to medical microbiology. Classification of medically relevant bacteria. Structure and functions of the bacterial cell.
CW14, CW15 K4, K8	Lecture: Etiopathogenesis and epidemiology of infectious diseases (bacterial, viral, and fungal), including the immunopathogenesis and virulence factors related to invasion and inflammation. Metabolism and genetics of pathogenic bacteria.
CW9, CW11, CW12 K4, K8	Lecture: Classification and characteristics of Gram-positive bacteria.
CW10, CW11, CW12, CW14 K4, K8	Lecture: Classification and characteristics of Gram-negative bacteria.

CW10, CW11, CW12, CW14 K4, K8	Lecture: Classification and characteristics of anaerobic and atypical bacteria.
CW10, CW11, CW12, CW14 K4, K8	Lecture: Yeasts and molds fungi: structure and biological properties, classification, pathogenicity, and epidemiology. Mycotoxins. Antifungal chemotherapeutics.
CW10, CW11, CW12, CW14 K4, K8	Lecture: Overview of DNA and RNA viruses pathogenic to humans: characteristics, immunopathogenesis, epidemiology, prevention, and antiviral therapy. Interferons. HIV and AIDS. Oncogenic viruses.
CW10, CW11, CW12, CW14 K4, K8	Lecture: Selected invasive infections (bloodstream infections, sepsis, meningitis). Biofilm-associated infections.
CW9, CW32 K4, K8	Lecture: Sexually transmitted infections. Microbiology in medical practice.
CW10, CW11, CW12, CW14 K4, K8	Lecture: Antimicrobial therapy. Overview of antibacterial, antifungal, and antiviral chemotherapeutic agents. Planning of the rational antimicrobial therapy based on identification of causative agents and their drug resistance. Strategies for discovering new antimicrobial agents.
CW10, CW15 CU5 K4, K8	Classes: Course organization. Safety precautions in the clinical microbiology laboratory. Theoretical part: Principles of microscopy. Practical part: Study of the bacterial cell morphology under the light microscope.
CW10, CW11, CW15 CU5 K4, K8	Classes: Theoretical part: Introduction to medical microbiology. Classification and characteristics of microorganisms The essential and nonessential bacterial cell structures and their function. Practical part: Bacterial cell morphology - research methods. 1. Techniques of slide preparation. 2. Techniques of bacterial staining. 2.1. Gram staining and microbial cell morphology under the light microscope. 3. Special staining methods: Neisser's, Dorner's, Maneval's, Ziehl–Neelsen's staining, and others
CW10, CW15 CU5, CU6 K4, K8	Classes: Theoretical part: Bacterial physiology and genetics. Bacterial growth and cell division. Bacterial metabolisms. Practical part: Bacterial morphology and physiology - research methods. 1. Principles of microbial culture methods. 1.1. Culture media 1.2. Basic microbiological techniques: inoculation, isolation, incubation, inspection and identification of microorganisms.
CW10, CW15 CU5, CU6 K4, K8	TEST 1: General Microbiology Classes: Theoretical part: Bacterial metabolisms. Classification and characteristics of aerobic, microaerophilic and anaerobic bacteria. Practical part: Bacterial morphology and physiology - research methods. 1. Colony morphology and growth patterns on culture media. 2. Culture media and methods for isolation and cultivation of anaerobic and microaerophilic bacteria. 2. Bacteria identification methods 2.1. Physiological (biochemical) identification methods. 2.2. Modern identification methods (genetic and mass spectrometry methods).
CW10, CW12, CW15 CU5, CU6 K4, K8	Classes: Theoretical and practical part: Classification and characteristics of Gram-positive bacteria *(Staphylococcus, Streptococcus, Enterococcus, Bacillus, Corynebacterium, Listeria*, etc.); culture and identification methods.
CW10, CW12, CW15 CU5, CU6 K4, K8	Classes: Theoretical and practical part: Classification and characteristics of Gram-negative bacteria (*Enterobacterales*, *Pseudomonas, Neisseria, Haemophilus, Bordetella*, etc.); culture and identification methods.
CW10, CW12, CW15 CU5, CU6 K4, K8	Classes: Theoretical part: Classification and characteristics of medically important fungi. Classification of human mycoses. Mycotoxins and mycotoxicoses. Practical part: 1. Culture and identification methods of yeasts and yeast-like fungi: *Candida, Cryptococcus, Saccharomyces Geotrichum*, and others. 2. Culture and identification methods of molds: *Aspergillus, Penicillium,* and others.
CW10, CW12, CW15 CU5, CU6 K4, K7, K8, K10	Seminar: Classification and characteristics of anaerobic and atypical bacteria: 1. Obligate intracellular pathogens (*Rickettsia, Chlamydia, Ehrlichia, Anaplasma*, Orientia, and *Coxiella*) 2. *Mycoplasma* and *Ureaplasma*. 3. Spirochetes (*Borrelia, Treponema, Leptospira*). 4. Mycobacteria. 5. Anaerobic bacteria – as a part of the human microbiota and important pathogens.
CW15, CW32 CU6, CU10, CU12 K4, K8	TEST 2: Classification and characteristics of medically important bacteria and fungi. Classes: Theoretical part: Antimicrobial therapy and prophylaxis. Empirical and definitive (targeted) antimicrobial therapy. Antibacterial agents. Practical part: Control of microbial growth in human diseases: 1. Antibiotic susceptibility testing (AST) and related terminology (MIC, MBC, MBQ, etc.). 1.1. Qualitative tests – disk diffusion method. 1.2. Quantitative tests: 1.2.1. Dilution methods. 1.2.2. Gradient diffusion method (Etest). 1.2.3. Automated methods 2. Interpretation and reporting of AST results (EUCAST/CLSI guidelines).

CW9, CW15, CW32 CU6, CU10, CU12 K4, K8	Classes: Theoretical part: Review of antibacterial agents: mechanisms of action, spectrum and activity, and mechanisms of resistance. Practical part: 1. Detection methods for antimicrobial resistance and interpretation of the results: 1.1. β-lactamases (ESBL, AmpC, NDM, KPC, and others). 1.2. Resistance to vancomycin among staphylococci (VISA, VRSA) and enterococci (VRE). 1.3. MLS_B (*macrolide-lincomycin-streptogramin* B) type of resistance. 1.4. HLAR (*high-level aminoglycoside resistant*) type of resistance among enterococci. 1.5. Resistance to methicillin in *Staphylococcus* to methicillin (MRSA, MRCNS). 1.6. Resistance to penicillin or/and ampicillin among *Streptococcus pneumoniae* (PISP; PRSP), *Haemophilus* spp., *Neisseria* spp., *Moraxella catarrhalis* and others.
CW9, CW15, CW32 CU6, CU10, CU12 K4, K7, K8, K10	Seminar: 1. The problem of increasing antibiotic resistance – causes, solutions and possible approaches. 2. Principles of rational antibiotic therapy and antimicrobial stewardship guidelines. 3. Alert pathogens.
CW11, CW12, CW17 CU6, CU12 K4, K8	Classes: Theoretical and practical part: Microbial growth control methods 1. Disinfection methods and levels. 2. Sterilization methods and their control. 3. Aseptic and antiseptic procedures. 3.1. Hand hygiene and use of antiseptics for skin preparation. 4. Microbiological control of air and surfaces. 5. Principles of sterility testing of drugs and medical equipment.
CW15, CW16 CU5, CU6	TEST 3: Antimicrobial therapy and microbial growth control (disinfection, sterilization, antisepsis). Classes: Theoretical and practical part: Collection, handling, and transport of clinical specimens for clinical specimens for microbiological diagnosis. Diagnosis of infectious diseases (culture methods, serologic and molecular tests)
CW11, CW12, CW14, CW15, CW32 CU5, CU6, CU10 K4, K8	Classes: Theoretical and practical part: 1. Etiology, pathogenesis, epidemiology, diagnosis and treatment of: 1.1. Urinary tract infections (UTIs). 1.2. Sexually transmitted infections (STIs), congenital peri- and postnatal infections. 1.3. Gastrointestinal tract infections (GTIs) and food-poisoning (intoxcication).
CW11, CW12, CW14, CW15, CW32 CU5, CU6, CU10 K4, K8	Classes: Theoretical and practical part: 1. Etiology, pathogenesis, epidemiology, diagnosis and treatment of: 1.1. Respiratory tract infections (RTIs). 1.2. Central nervous system (CNS) infections.
CW11, CW12, CW14, CW15, CW32 CU5, CU6, CU10 K4, K8	Classes: Theoretical and practical part: 1. Etiology, pathogenesis, epidemiology, diagnosis and treatment of bloodstream infections (sepsis, toxic shock, endocarditis, and others).
CW9, CW10, CW11, CW12, CW14, CW17, CW32 CU6, CU10, CU12 K4, K7, K8, K10	Seminar: Healthcare-Associated Infections (HAIs). 1. Definitions, epidemiology, and risk factors. 2. The most common etiological agents and clinical forms of HAIs. 3. Prevention and infection control. 4. Monitoring and reporting of alert pathogens. 5. Molecular methods in the diagnosis of infections and in epidemiological investigations.
CU5, CU6 K4, K8	Evaluation of practical skills

Obligatory textbook:

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:

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.

Criteria for assessing the achieved learning outcomes and the form and conditions for receiving credit:

Student Responsibilities

1. **Participation in lectures, laboratory classes (labs), seminars, and credits is obligatory**. **All absences must be justified.**
2. Students are obliged to keep a record of lab/seminar results in their exercise books, and to monitor the results from in-semester credits as well as make up missed lab/seminar/credits within the appointed time.
3. Students must be prepared to actively participate in labs/seminars based on recommended textbooks and labs/seminars/lectures materials.
4. **Students missing more than four labs/seminars or more than three lectures** (even if the absences are justified), **will not be admitted to the final exam** (additional information can be found in the Department's didactic guidelines).
5. **Students must adhere to safety precautions and follow the Department's didactic regulations while attending labs/seminars/credits.**
6. **In-semester course credits include:** (i) two lab quizzes, (ii) three tests, and (iii) a final evaluation of practical skills (exemptions are allowed for students who meet the criteria specified in the Department's didactic regulations).
7. **To obtain credit for the 'Microbiology' course students must:**
   - successfully complete all labs/seminars,
   - collect at least 60 points (≥60%) out of the total 100 points available from all tests and quizzes, or if they obtained ≤30 points (≤30%), achieve ≥60% on the additional test (i.e., pre-exam),
   - pass the final practical assessment with a score of ≥60%.
8. **The final theoretical exam** (test) may be taken only by students who obtained credit for the 'Microbiology' course. Students may be exempted from the final exam if they meet the criteria specified in the Department's didactic regulations.

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 Department where the course is held) *and* *(course coordinator)*