MINISTRY OF HIGHER EDUCATION, SCIENCE AND INNOVATIONS OF THE REPUBLIC OF UZBEKISTAN
MINISTRY OF HEALTHCARE OF THE REPUBLIC OF UZBEKISTAN

TASHKENT STATE MEDICAL UNIVERSITY

«APPROVED »
Tashkent State Medical University
Vice-Rector for Academic Affairs
Q.N. Haitov
_____
2025 Year «28» 08

SYLLABUS ON MICROBIOLOGY, VIROLOGY AND IMMUNOLOGY

For the full-time department

Field of Knowledge:	**900 000**	**–**	**Health Care and Social Welfare**
Field of Education:	**910 000**	**–**	**Health Care**
Direction of education	**60910400**	**–**	**Medical Preventive Work**

Tashkent – 2025

Faculty Public Health, Ecology and Environmental Protection, and Chemistry Study Program: 60910400 – Medical Preventive Work

Module Name:	**Microbiology, Virology, and Immunology**
Module Type:	**Mandatory**
Module Code	**M14508**
Academic Year:	**2025/2026**
Semester:	**4-5**
Form of education:	**Daytime**
Form of classes and hours per semester:	**240**
Lectures:	**24**
Practical Classes:	**66**
Laboratory Sessions:	**30**
Seminars:	**-**
Independent Study:	**120**
Credit Amount:	**8**
Assessment form:	**YaN (Test)**
Language of Instruction:	**Uzbek, Russian and English**

Module Objective (MO)	
MO1	The objective is to provide students with both theoretical and practical foundations, as well as the principles of microbiology, virology, immunology, mycology, and parasitology; to teach them how to isolate, detect, and identify infectious disease pathogens; and to develop skills for the correct interpretation of results and their application in practice.
Prerequisite Knowledge for Mastering the Course	
1.	The aims and objectives of the module in medical microbiology, virology and immunology and their importance for the general practitioner
2.	Microbiology laboratories, reagents, equipment, work with laboratory animals and compliance with safety regulations
3.	Classification of microbes and viruses, morphological structure and physiology, biological and pathogenic properties and their impact on public health
4.	Microbial ecology and the distribution of microorganisms in the environment
5.	Understand the specific and nonspecific protective factors of the body and their practical significance. The main types of microorganisms and their distribution in nature; the taxonomic classification, as well as the morphological and biological characteristics of bacteria pathogenic to humans.

Learning Outcomes (LO)	
	In terms of knowledge:
1	The goals and objectives of the Microbiology, Virology, and Immunology module, and its importance in the professional activity of a general practitioner.
2	Compliance with safety rules when working in microbiological laboratories with reagents, instruments, and laboratory animals.
3	The classification, morphology, structure, and physiology of microbes and viruses,

	their biological and pathogenic properties, and their impact on public health.
4	The ecology of microorganisms and their distribution in the external environment.
5	The influence of environmental factors on microorganisms.
6	The processes and characteristics of symbiosis between the human body and microbes, and the role of resident microflora in the development of opportunistic diseases.
7	Knowledge of the body's specific and non-specific defense factors and their practical significance, as well as an understanding of the main types of microorganisms, their distribution in nature, and the taxonomic system, morphological, and biological characteristics of bacteria pathogenic to humans.

	In terms of skills:
8	The genetic control characteristics of microbial pathogenicity and antibiotic resistance, the mechanisms of resistance development, and the methods for its detection.
9	Methods of sterilization and disinfection of instruments, equipment, and dressing materials for the prevention of infections.
10	The differential characteristics of infectious disease pathogens.
11	Laboratory diagnostic methods.
12	Specific preventive measures for diseases.
13	The ability to detect sanitary-indicative microorganisms in the environment and food, to understand the objectives and tasks of the module, its significance in the professional activity of a general practitioner, and to apply this knowledge in practice.

Module Content	
Form of training: lecture (L)	
L1	The objectives and tasks of the medical microbiology, virology, and immunology modules. Morphology of bacteria. Structure and size of the bacterial cell. Their significance in microbiological practice. Microscopic diagnostic methods.
L2	Physiology of microorganisms. Nutrition of bacteria. Growth and reproduction of bacteria. General virology. Bacteriophages.
L3	The effect of environmental factors on microorganisms. Sterilization. Asepsis, antisepsis, disinfection. Antibiotics and their classification. Mechanism of action of antibiotics.
L4	Ecology of microorganisms. Microflora of water, soil, and air. Human microbiota, methods of its study, and its significance in medical practice.
L5	Doctrine of infection. Genetics of microorganisms
L6	History of immunology. Objectives and tasks of immunology. Types of immunity. Innate immunity. Antigens and antibodies. Serological reactions.
L7	Pathogens of purulent-inflammatory diseases and wound anaerobic infections, their specific characteristics, laboratory diagnostics, and methods of specific prevention.
L8	Pathogens of airborne bacterial infectious diseases, their specific characteristics, laboratory diagnostics, and methods of specific prevention.
L9	Pathogens of intestinal bacterial infectious diseases. Pathogens of typhoid fever and paratyphoid fevers. Foodborne infectious diseases and toxico-infections, their specific characteristics, laboratory diagnostics, and methods of specific prevention.

L10	Pathogens of zoonotic infectious diseases (plague, anthrax, brucellosis, tularemia), their specific characteristics, laboratory diagnostics, and methods of specific prevention. Characteristics of pathogens of sexually transmitted infections. Vector-borne infections, their specific characteristics, laboratory diagnostics, and methods of specific prevention.
L11	Infectious diseases caused by RNA-containing viruses. Their epidemiology and pathogenesis. Formation of antiviral immunity. Laboratory diagnostics and methods of specific prevention.
L12	Infectious diseases caused by DNA-containing viruses. Their epidemiology and pathogenesis. Formation of antiviral immunity. Laboratory diagnostics and methods of specific prevention.

Form of training: practical training (P)	
P1	Microbiological and virological laboratories and their equipment. Rules and procedures for working in laboratories. Morphology of bacteria. Methods of their examination. **(Laboratory work 1).**
P2	Structure of the bacterial cell: permanent structures of the bacterial cell. Chemical composition and their functional significance. Structure of Gram-positive and Gram-negative bacteria and their differences **(Laboratory work 2).**
P3	Non-permanent structural elements of microorganisms: spores, capsules, pili, inclusions, and methods for their study. **(Laboratory work 3).**
P4	Spirochetes, mycoplasmas, chlamydiae, rickettsiae, actinomycetes, fungi, and their morphology and structure. **(Laboratory work 4).**
P5	Physiology of bacteria: chemical composition, nutrition, growth, and reproduction. Nutrient media. Methods for isolating pure bacterial cultures (Day 1). **(Laboratory work 5).**
P6	Physiology of bacteria: catabolic metabolism—respiration and its types. Stages of isolating pure cultures of aerobes and anaerobes. Cultural characteristics during isolation of pure cultures (aerobes—Day 2, anaerobes—Day 1 **(Laboratory work 6).**
P7	Physiology of bacteria: constructive metabolism and their enzymes. Products of bacterial life activity (enzymes, pigments, aromatic substances, etc.). Methods for isolating and identifying pure cultures (based on pathogenicity factors and biochemical properties). Stages of isolating pure cultures of aerobes and anaerobes. **(Laboratory work 7).**
P8	Distribution of microbes in the environment. Microflora of water, air, soil, and living spaces. Fundamentals of sanitary microbiology. Methods for sanitary bacteriological assessment of environmental microflora.
P9	Factors affecting microorganisms: physical, chemical, and biological. Methods for eliminating microbes in the environment. Antibiotics. Antibacterial chemotherapy. Spectrum of antimicrobial activity. Bacteriocins. **(Laboratory work 8).**
P10	Ecology of microorganisms. Normal microflora of the human body, its significance and functions. Dysbacteriosis. .
P11	Infection. Pathogenic and opportunistic microorganisms. Infectious processes, transmission, and routes of spread. Methods for diagnosing infectious diseases. Genetics and variability of microorganisms
P12	General virology: structure, morphology, reproduction, and chemical composition.

	Bacteriophages. Methods for isolating viruses. Methods for indication and identification of viruses. Methods for diagnosing infectious diseases caused by viruses. **(Laboratory work 10).**
P13	Immunity. Structure and functions of the immune system. Mechanisms of innate immunity (complement system, phagocytes, etc.). Antigen-presenting cells.Immunitet. **(Laboratory work 11).**
P14	Antigens and antibodies. Immunological reactions, their components (antigens, antibodies), and their purposes. Understanding of diagnostic kits and diagnostic sera. Methods for obtaining diagnostic sera. **(Laboratory work 12-13).**
P15	Adaptive immunity. T and B lymphocytes and their subpopulations. CD markers. Mechanisms of humoral and cell-mediated immune responses. Laboratory assessment of T and B lymphocytes. **(Laboratory work 17).**
16	Microorganisms causing purulent-inflammatory diseases, including staphylococci, streptococci, and *Pseudomonas aeruginosa*; and the laboratory diagnosis of the diseases they cause.
P17	Wound infections: description and laboratory diagnosis of the causative agents of gas gangrene and tetanus. .
P18	Airborne infections: description of diphtheria, pertussis, pneumococci, and meningococci, and diagnosis of the diseases.
P19	Airborne infections: description of the causative agents of tuberculosis, diphtheria, actinomycosis, and diagnosis of the diseases.
P20	Causative agents of bacterial intestinal infections: Enterobacteria, their taxonomy, biological characteristics, and role in human pathology. Microbiological diagnosis and specific prevention of coli-infections and yersiniosis.
P21	Causative agents of shigellosis and cholera. Their taxonomy. Main biological characteristics and role in human pathology. Microbiological diagnosis and specific prevention.
P22	Diseases caused by the causative agents of typhoid and paratyphoid A and B: description, prevention, and laboratory diagnosis.
P23	Foodborne infectious diseases and food poisoning. Causative agents of salmonellosis and botulism, and their laboratory diagnosis.
P24	Causative agents of zoonotic infectious diseases (Bacillus anthracis, Brucella species). Their taxonomy, main biological characteristics, description of the diseases, laboratory diagnosis, and prevention. **(Laboratory work).**
P25	Sexually transmitted infections: description and diagnosis of the causative agents of syphilis and gonorrhea. **(Laboratory work).**
P26	Causative agents of vector-borne infections. Rickettsiae: typhus, Brill's disease, endemic (murine) typhus (Country: Moscow, Russia; University: Lomonosov Moscow State University; Ranking: 94). Coxiella burnetii. Borreliae: causative agents of relapsing fever. Their taxonomy, main biological characteristics, and role in human pathology. Methods for microbiological diagnosis and prevention.
P27	RNA viruses causing respiratory diseases in humans: orthomyxoviruses, paramyxoviruses, coronaviruses. Their general characteristics and role in human pathology. Virological diagnosis and specific prevention. **(Laboratory work).**

P28	Picornaviruses (poliomyelitis). Rhabdoviruses (rabies). Fecal–oral transmitted hepatitis A and E viruses. Virological diagnosis and prevention.
P29	Retroviruses. Human immunodeficiency viruses. Hepatotropic viruses B, D, C. Virological diagnosis and prevention **(Laboratory work).**
P30	Herpes viruses (subfamilies α, β, γ) and Poxviruses (smallpox). Monkeypox virus. Classification, morphology and structure, and laboratory diagnosis. **(Laboratory work).**

Independent education (IE)		**Hours**
1	Leading Uzbek scientists who have contributed to the development of the microbiology, virology, immunology, and parasitology module.	4
2	Classification, taxonomy, and nomenclature of bacteria. Identifier “Bergie”. Variants within bacterial species not included in classification but used in practice (serovar, chemovar, phagovar, fermentovar, etc	4
3	Fungi. Their morphology, structure, and methods of study.	4
4	Simple animals. Their morphology, structure, and methods of study.	4
5	Concept of prions, their origin, prion diseases, and significance in practice. Nutrient media, chromogenic media, and their use in identification.	4
6	Current approaches in rapid bacterial diagnosis, molecular genetic methods based on polymerase chain reaction, sequencing of the 16S ribosomal RNA gene, electromigration techniques, including capillary zone electrophoresis and capillary isoelectric focusing	4
7	Methods of energy acquisition by microorganisms. Forms of cellular energy and their generation. Fermentation. Pathways of carbohydrate fermentation. Types of fermentation.	4
8	Sanitary bacteriological assessment and analysis of food products (milk and meat).	4
9	Modern sterilization methods in medicine. Bacteriological assessment of sterilization and disinfection methods. Mechanisms of formation of bacterial resistant strains to chemotherapeutic agents and antibiotics.	4
10	Dysbacteriosis and dysbiosis, contributing factors. Bacteriological diagnostic methods for dysbacteriosis and dysbiosis. Probiotics used in dysbacteriosis.	4
11	Extrachromosomal factors of bacterial heredity (plasmids, transposons, IS elements, temperate phages) and their significance in practice.	4
12	Bacteriophages: morphology, structure, reproduction, and their applications in practice (treatment, identification, prevention).	4
13	Concepts of immunity (theoretical): phagocytic, humoral, clonal selection, and others. First class of major histocompatibility complex – HLA-A, -B, and -C molecules, and their functions.	4
14	Monoclonal antibodies, their production, types, and applications in practice. Cytokines and **i**nterferons: synthesis and mechanism of action.	4
15	Immunodeficiency states (congenital and acquired during life). Fundamentals of immunoprophylaxis and immunotherapy**.**	4
16	Opportunistic pathogenic anaerobic cocci (Peptococcus, Peptostreptococcus,	4

	Veillonella): their significance in surgical and gynecological diseases, and laboratory diagnosis	
17	Pathogenic non-clostridial anaerobic infection agents (Bacteroides, Prevotella, Fusobacterium): pathogenesis of diseases and laboratory diagnosis. (Country: Moscow, Russia; University: Lomonosov Moscow State University; Ranking: 94).	4
18	Description of pneumococci and meningococci, pathogenesis of diseases caused by Haemophilus influenzae, and laboratory diagnosis.	4
19	Actinomycosis: description of causative agents and laboratory diagnosis of the diseases they cause. Atypical mycobacteria and their significance in practice, and laboratory diagnosis of the diseases they cause.	4
20	Campylobacter and Helicobacter species and their significance in practice. Diseases they cause and laboratory diagnosis.	4
21	Amoebic dysentery and the diseases it causes, laboratory diagnosis. (Country: Moscow, Russia; University: Lomonosov Moscow State University; Ranking: 94)	4
22	Opportunistic pathogenic diarrheagenic intestinal bacteria: Citrobacter, Klebsiella, Enterobacter, and their significance in practice. Diseases they cause and laboratory diagnosis.	4
23	Foodborne poisoning diseases caused by Proteus, Salmonella, Campylobacter, Escherichia coli, and Listeria. Classification of Salmonella based on antigenic properties (Kaufmann-White scheme). Serological identification of intestinal group bacteria.	4
24	Diseases caused by Yersinia pestis and Francisella tularensis: pathogenesis, laboratory diagnosis, specific prevention and therapy. (Country: Moscow, Russia; University: Lomonosov Moscow State University; Ranking: 94).	4
25	Description and diagnosis of the causative agents of chlamydiosis, mycoplasmosis, and trichomoniasis. Microbiological diagnostic methods.	4
26	Borrelia (Lyme disease). Morphology, structure, distribution of leptospires, diseases they cause, and laboratory diagnosis. .	4
27	Avian and swine influenza viruses, respiratory syncytial virus, rhinoviruses, their current issues, diseases they cause, and laboratory diagnosis.	4
28	Ebola, Lassa, and Zika viruses: pathogenesis of diseases and laboratory diagnosis.	4
29	Pathogenic fungi, the diseases they cause, pathogenesis, and laboratory diagnosis**.**	4
30	Opportunistic hospital-acquired infectious agents (HAIs), their role in etiology. Diagnosis and prevention of nosocomial infections.	4

List of Practical Skills	
1	Working with a microscope.
2	Preparation of native and fixed smears from pathological material and microbial cultures.
3	Staining prepared smears using simple and complex methods.
4	Identifying and diagnosing micropreparations under a light microscope in an immersion

	system based on morphological characteristics.
5	Inoculating pathological materials onto dense nutrient media using various bacteriological methods.
6	Isolation of pure bacterial cultures and their identification.
7	Determining bacterial sensitivity to antibiotics and bacteriophages.
8	Serological identification of bacteria.
9	Indication and identification of viruses.
10	Application of serodiagnostic and molecular genetic methods in the diagnosis of infectious diseases.
11	Methods for sanitary bacteriological evaluation of environmental objects.

Main References	
1	Muhamedov I.M., Aliyev Sh.R., et al. Microbiology, Virology, and Immunology. Textbook. Tashkent, 2019.
2	Edited by Professor I.M. Muhamedov. Medical Microbiology, Virology, and Immunology. Textbook. Tashkent, 2011**.**
3	Aliyev Sh.R., Nuruzova Z.A. Laboratory Exercises in Microbiology: Educational and Methodical Guide. Tashkent, 2019.
4	Muhamedov I., Eshboyev E., Zokirov N., Zokirov M. Microbiology, Immunology, Virology. Textbook. Tashkent, 2006.
Additional References	
1	Zverev V.V. Medical Microbiology, Virology, and Immunology. Textbook. Moscow, 2016.
2	Mukhamedov I. M. et al. “Medical Virology”, Study Guide, Tashkent, 2013.
3	Muhamedov I. M. et al. Clinical Microbiology: A Guide for Physicians. Tashkent, 2016.
4	Aliyev Sh.R., Muhamedov I.M., Nuruzova Z.A., et al. Laboratory Works in the Microbiology, Virology, and Immunology Module. Educational and Methodical Guide. Tashkent, 2013.
5	Nuruzova Z.A., Aliyev Sh.R., Yodgorova N.T., et al. Laboratory Works on Microbiology, Virology, and Immunology. Educational and Methodical Guide. Tashkent, 2019.
6	Robert F. Boyd. Basic Medical Microbiology. Lippincott Williams & Wilkins, 2000. Printed in the United States of America.
7	Gerard J. Tortora, Berdell R. Funke, Christine L. Case. Microbiology. Benjamin Cummings, USA, 2015.
8	Murray P.R. Medical Microbiology. Elsevier Mosby, 2015.
9	Y. Levinson. Medical Microbiology. California, 2015. Information technology tools: topic-based video clips, electronic textbooks, computers, handout materials.
10	Z.A. Nuruzova, Z.R. Fayzullayeva, N.T. Yodgorova, F.Sh. Mamatmusayeva. Microbiology, Virology, and Immunology (for the Faculty of Traditional Medicine). Textbook. Tashkent: Medical Publishing House, 2023.
11	Z.A. Nuruzova, F.Sh. Mamatmusayeva, B.A. Ramazanova, K.K. Mustafina.

	Clinical Microbiology (for the Faculty of Medical Prevention). Textbook. Tashkent: Medical Publishing House, 2023.

Criteria for Assessing a Student's Mastery of the Subject

100-Point Grading System	5-Point Grading System	To earn points, a student's level of knowledge must meet the following requirements:
90-100	5	- Can fully explain the essence and content of the subject. - Maintains scientific accuracy and logical consistency when presenting topics, avoiding mistakes and confusion. - Has a clear understanding of the theoretical and practical significance of the subject material. - Demonstrates independent and critical thinking skills. - Provides precise and concise answers to given questions. - Can apply theoretical knowledge in various situations. - Refers to additional literature, scientific articles, and research, and acquires up-to-date information on the topic. - Performs laboratory work independently and step by step, and can explain the process. - Has thorough knowledge of the rules of working with a microscope. - Can independently prepare smears, carry out staining methods, isolate pure cultures, and perform identification. - Masters all practical skills and competencies. - Completes assignments in practical classes fully and accurately, and can interpret results. - Records practical class reports in the notebook completely and draws diagrams correctly. - Regularly attends classes without unexcused absences. - Actively participates in Q&A sessions, confidently expressing opinions. - Engages in interactive games, case studies, and group tasks, and is able to make correct decisions. - Correctly interprets biochemical reactions. - Creatively and accurately solves case studies. - Draws logical and positive conclusions from obtained results and can fully justify them. - Prepares cases, problem tasks, and presentations independently. - Writes theses and articles on subject topics. - Can present conclusions in both written and oral form. - Makes independent decisions, thinks creatively, and reasons logically. - Can independently carry out culture isolation and identification. - Shows active participation in practical classes. - Attends classes regularly, without unexcused absences. - Actively participates in interactive games, case studies, and

		group tasks, making correct decisions. - Correctly interprets biochemical reactions, draws logical conclusions from results, and substantiates own opinions. - Independently prepares and presents cases, problem tasks, and presentations. - Writes theses and articles on subject topics. - Can explain own conclusions both in written and oral forms.
70-89.9	4	- Understands the essence and content of the subject and presents topics scientifically and logically without errors or confusion; - Understands the practical significance of the subject content; - Completes assigned tasks and exercises within the curriculum framework; - Provides correct answers to questions related to the subject; - The ability to perform laboratory work under the supervision of a teacher; - Completes independent assignments thoroughly; - Demonstrates acquisition of all practical skills and competencies. Performs laboratory work independently and step by step, and is able to explain it. - Does not fully or properly follow the rules of working with a microscope. - Is unable to independently prepare smears, apply staining methods, isolate pure cultures, and carry out their identification. - Does not possess all the necessary practical skills and abilities. - Completes practical assignments only with the participation of the instructor and is able to explain the results. - During the practical session, studies the morphology of bacteria under the microscope and draws the illustrations correctly.
60-69.9	3	Has a general understanding of the subject; - Covers topics in a limited scope and may make some errors or inconsistencies in presentation; - Presentation is not fully fluent; - Provides vague or unclear answers to subject-related questions; - Lecture notes are not well-prepared.
0-59,9	2	- Has not prepared for classes in the subject; - Has no understanding of the subject matter; - Lecture notes appear to be copied from others; - Makes serious errors and inconsistencies in the subject material; - Cannot answer questions related to the subject; - Does not know the subject.

Information about the Subject Instructor

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This Syllabus was approved by the Educational and Methodological Council of TSMU at the meeting protocol No. _____ dated __, **20**.

This Syllabus was endorsed by the meeting protocol №. 1 of the 08 Department, dated 28, 2025

Head of the Educational and Methodological Department **F.X. Azizova**

Dean of the faculty **F.I. Salomova**

Head of the department **Z.A.Nuruzova**