

**HIGHER EDUCATION OF THE REPUBLIC OF UZBEKISTAN,**  
**MINISTRY OF SCIENCE AND INNOVATION**  
**KOKAND STATE UNIVERSITY**

**MICROBIOLOGY AND VIRUSOLOGY**

**SCIENCE CURRICULUM**

Field of Knowledge: 500000 – Natural sciences, mathematics and statistics  
Field of Study: 510000 – Biology and related sciences  
Type of Study: 60510100 – Biology

<b>Subject/module code</b> MV134510	<b>Academic year</b> 2025 -2026 2026-2027	<b>Semester</b> 4-5	<b>Credits</b> 5-5	
<b>Subject/module type</b> Selection	<b>Language of instruction</b> Uzbek/Russian		<b>Weekly class hours</b> 4/4	
<b>1.</b>	<b>Name of science</b>	<b>Auditory training (hours)</b>	<b>Independent study (hours)</b>	<b>Total load (hour)</b>
	<b>Microbiology and virology</b>	60/60	90/90	150/150
<b>2.</b>	<p><b>I. The content of science</b></p> <p>The goal of teaching the science is to provide students with an understanding of general microbiology, the development of microorganisms, the nutrient environment, phytohormones, the resistance of microorganisms to adverse factors, systematics, reproduction, distribution, and their importance in the national economy, and to develop the skills to apply them in practice.</p> <p>The task of the subject is to expand, deepen, and systematize the knowledge students have acquired about microorganisms in secondary and secondary specialized schools; to develop knowledge of microorganisms in the microbiological context; to study the essence of physiological and biochemical processes in microorganisms, the laws of growth and development, the physiology of reproduction, formation, and the processes occurring during the storage of agricultural products; to determine the intensity of reproduction and development, the degree of change in their activity indicators, the morpho - physiological to indicators looking at mineral feed of elements lack or excess amount diagnosis It is about teaching students to do.</p>			
	<p><b>II. Main theoretical part (lectures)</b></p> <p><b>III. The subject includes the following topics:</b></p> <p><b>Topic 1: General microbiology, objects of study, tasks, departments and brief history of development</b></p> <p>The subject of microbiology and virology, objects of study, the importance of studying microorganisms, the relationship of science with other sciences, a description of its departments and tasks. The emergence of the first concepts about microorganisms. The discovery and importance of microscopy techniques. About the morphological period of microbiology and the work of scientists who contributed to the development of this period, the creation of the systematics of microorganisms, the physiological period of microbiology and the work of scientists who contributed to the development of this period, the development of the science of microbiology in Russia and in our country, the biochemical period of microbiology and its development.</p> <p><b>Topic 2: Morphological types of various microorganisms description</b></p>			

Morphology and cell size of microorganisms. Cell structure of microorganisms. Eukaryotic and prokaryotic microorganisms. Shapes of bacterial cells. Description of different groups of microorganisms.

### **Topic 3: Cellular structure and chemical composition of microorganisms**

Methods of studying the bacterial cell. External and internal organelles of the bacterial cell, chemical composition. Movement of microorganisms. Spore and its structure, importance, formation. Bacterial cell wall. Cytoplasmic membrane and its structure. Microorganism cell cytoplasm, organelles and its chemical composition.

### **Topic 4: Systematics of microorganisms**

Systematics and its importance in grouping microorganisms. Nomenclature. Modern classification of microorganisms. Principles of classification of microorganisms. Naming and systematic categories of microorganisms and their description. Divisions of the prokaryotic world and their description.

### **Topic 5: Growth and development of microorganisms**

Growth and reproduction in microorganisms, specific aspects. Phases of reproduction of microorganisms. Control of reproduction of microorganisms, obtaining useful products from microorganisms in industry.

### **Topic 6: Nutrition of microorganisms**

Nutrients and their importance in the life of microorganisms. Types of nutrition of living organisms. The importance of water in the nutrition of microorganisms. Transport of nutrients and their entry into the cell. The need of microorganisms for nutrients. The composition of the bacterial cell. Types of nutrition of microorganisms. The need of microorganisms for carbon.

### **Topic 7: Metabolism of microorganisms**

Metabolism and its main stages. Catabolism and its stages. Biosynthesis and its importance. Metabolism and its stages. Anabolism and its importance. Microorganism enzymes and their importance. Accumulation of energy in the microorganism cell. Oxidation and reduction of organic compounds. Synthesis and its types, stages, importance. Respiration of microorganisms.

### **Topic 8: Genetics of microorganisms**

General concept of the genetics of microorganisms. The concept of heredity and variability in microorganisms. Genotype and phenotype of microorganisms, hereditary variability. Mutations in the world of microorganisms. Transformation and transduction in bacteria. Episodes.

### **Topic 9: The influence of environmental factors on microorganisms**

Environment, environmental factors and their types. Physical factors and their effects on microorganisms. Chemical factors and their effects on microorganisms. Biotic factors and their effects. Levels of influence of environmental factors.

The main types of interactions of microorganisms with other organisms. Symbiosis, metabiosis, antagonism. Types of relationships between microorganisms. Neutralism, mutual competition, mutual competition for elements, amensalism, parasitism, predation, cimmenalism,

proto-cooperation, mutualism. Relationships of microorganisms with plants. Phytopathogenic microorganisms. Rhizosphere and rhizoplano microorganisms. Epiphytic microorganisms. Relationships between soil microorganisms and soil animals.

### **Topic 10: Ecology of the biosphere and microorganisms, the importance of microorganisms**

Biosphere and its composition. Boundaries of the biosphere. Elemental composition of microorganisms. The role of microorganisms in the decomposition of rocks. The role of microorganisms in the cyclical circulation of matter and energy. The role of microorganisms in the cycle of sulfur in nature. The role of microorganisms in the cyclical cycle of iron.

The importance of nitrogen. The nitrogen cycles. Nitrogen mineralization. Ammonification and microorganisms involved in this process. Nitrification. Nitrogen immobilization. Biological immobilization of nitrogen. Denitrification and microorganisms involved in this process.

Microorganisms and their importance. Pathogenic microorganisms. Phytopathogenic bacteria and their importance. Phytopathogenic fungi and their importance in the national economy and medicine. Distribution of phytopathogenic bacteria and measures to combat them.

### **11. Understanding the nature of viruses**

Plant and bacterial viruses. Viruses are causative agents of infectious diseases. The importance of viruses in health care, agriculture and other fields.

### **Topic 12. Research methods used in virology**

Methods of studying viruses (loading viruses, studying their physical and chemical properties, methods of obtaining pure preparations and their components (protein, nucleic acid). Propagation and isolation of viruses. Various centrifugation methods. Methods of determining virulence.

### **Topic 13. Structure of viruses**

Size, shape and structure of virus particles. Typical representatives of viruses belonging to different groups: tobacco mosaic virus and its strains, T-2 bacteriophage. Morphological structure of AIDS, influenza and x. viruses. General structure of viruses. Viral proteins and nucleic acid.

### **Topic 14. Spread of viruses**

Transmission routes of viruses. Spread of plant viruses. Spread of vertebrate and invertebrate viruses.

### **Topic 15. Viruses and their classification**

General concepts of virus classification. Virus classification (Gibbs and Harrison, 1976, Fields and Nape, 1989, Zhdanov.1990). The main groups of viruses (animal, plant, bacterial) and a description of their representatives.

### **Topic 16. Virus diagnostics**

Diagnosis based on inserts. Diagnosis of viruses using the method of diagnostic plants and their application in virus isolation.

### **Topic 17. Diagnosis of viruses using immunological methods .**

Droplet method, virus-bacterial agglutination, immunoenzyme, radioimmunoassay, double immunodiffusion methods, etc. The use of various

external factors in the development of measures to combat viral diseases. The body's protective response. Vaccination.

### **Instructions and recommendations for practical training**

The following topics are recommended for practical training:

1. Asepsis rules. Study of the structure of a biological microscope and the rules of operation in it . Preparation of a fixed stained preparation.
2. Introduction to rod-shaped microorganisms and their morphology.
3. of SH - like bacteria and their morphological structure .
4. Study of the formation and movement of spores and capsules of bacteria .

Conduct an experiment on air microflora using the Omilyansky method.

5. Analysis of air microflora.
6. soil .
7. Sterilization methods, elective nutrient media used in the microbiology laboratory.
8. Study of the ammonification process and the microbiological basis of this process.
9. Analysis of the nitrification process and the microorganisms that carry out this process. Analysis of the denitrification process and the microorganisms that carry out this process.
10. Introduction to the process of nitrogen fixation and the chemistry of the nitrogen fixation process. Study of microorganisms living in symbiosis by preparing preparations from the roots and tubers of leguminous plants.
11. Lactic acid fermentation and analysis of microorganisms involved in this process. Oleic acid fermentation. Analysis of Rushman's nutrient medium.
12. Study of disease-causing microorganisms.
13. In the microbiology laboratory Preparing the culture media and equipment used for sterilization.
14. 18. Nitrification process and the organisms that carry out this process analysis of microorganisms.
15. Analysis of the denitrification process and the microorganisms that carry out this process.
16. Structure and operating rules of the virology laboratory.
17. Symptoms of phytopathogenic viral diseases.
18. Based on atlases and tables, the characteristics of humans and animals
19. studying the symptoms of viral diseases.
20. Identifying the spread and damage caused by viruses.
21. Studying the transmission routes of viruses.
22. Determination of the inactivation point of viruses under the influence of temperature. Determination of the final dilution level of viruses.
23. Determining the isoelectric point of viruses .
24. Obtaining a partially purified preparation of viruses.
25. Studying methods for obtaining pure virus preparations.
26. Determination of the quantity and purity of the virus preparation.

27. Detection of plant viruses using indicator plants.
28. Study the working principle of precipitation-based diagnostic methods.
29. Study of immunodiffusion-based methods and their application in virus detection.
30. Study of the immunoenzymatic assay method and its application in virus diagnostics.

#### **IV. Independent learning and independent work**

*Recommended independent study topics:*

1. Chemical composition of a bacterial cell.
2. Morphology and structure of bacteria
3. Morphology (external structure) of microorganisms
4. Systematics of prokaryotes
5. Shape, groups and systematics of viruses
6. Chemical composition of viruses.
7. Classification of viruses
8. Microorganisms nutrition and respiration
9. Three carboxylic acid rings (Krebs ring)
10. Microorganisms nitrogen nutrition
11. Chemosynthesis process
12. Oxidation of fats with the participation of microorganisms
13. Microorganisms lactic acid, alcoholic fermentation processes using
14. Oily acid fermentation
15. Butyl acetate and butyl acetate
16. Photosynthesis
17. Photosynthetic productivity of our planet
18. Plant polymers that are renewable through photosynthesis
19. The inextricable link between microbiology and genetics.
20. Current advances in microbiology.
21. Nutrient medium for microorganisms.
22. The role of microorganisms in metabolism.
23. Spread of microorganisms.
24. The origin of viruses and their significance.
25. Use of viruses in genetic engineering.
26. Viroids and their importance. P. Prions and their importance.
27. Developing vaccines against the virus.
28. The importance of phytopathogenic viruses in the national economy.
29. Human viruses that cause epidemics and pandemics, their spread, prevention and control measures.
30. Immunity and vaccination.
31. Methods for obtaining pure preparations of viruses.
32. Methods for obtaining specific antibodies to viruses.

	<p>33. Complex plant, human and animal viral diseases and their prevention.</p> <p>34. Modern classifications of viruses.</p> <p>35. Modern, highly sensitive diagnostic methods.</p> <p>36. The importance of viruses in various fields.</p>
	<p><b>V. Learning outcomes/Professional competencies</b></p> <p>As a result of learning a subject, the student:</p> <p><i>to have an idea</i> of the anatomy of microorganisms, their nutrition, respiration, their participation in biological processes, the role of microorganisms in heredity and mutation, the technologies for obtaining new drugs and their use in the microbiological industry, including the pharmaceutical industry ; (<b>knowledge</b>)</p> <p>- methods of studying microorganisms: classification, genetics, ecology and their importance in metabolism in nature, pathogenic microorganisms. Types of immunity, observation and recording of microorganisms grown on solid nutrient media, good study of the equipment used in the experiment, <i>knowledge of the laws and regulations of methods for multiplying microorganisms, their specific properties, and ability to use them correctly</i>; (<b>skills</b>) .</p> <ul style="list-style-type: none"> <li>• <b>general microbiology</b> , educational technologies, electronic posters, handouts, electronic textbooks and manuals, virtual laboratories, Internet information, various educational and scientific knowledge control databases on the local network are used. The subject is taught using pedagogical methods such as independent learning, brainstorming, solving situational problems, discussion, role-playing games, and writing abstracts, and students must have the skills to assess <i>their performance</i>. (<b>qualifications</b>)</li> </ul>
4.	<p><b>VI. Educational technologies and methods:</b></p> <ul style="list-style-type: none"> <li>- lectures;</li> <li>- interactive case studies;</li> <li>- seminars (logical thinking, quick questions and answers;</li> <li>- working in groups;</li> <li>- making presentations;</li> <li>- individual projects;</li> <li>- projects for teamwork and protection.</li> </ul>
5.	<p><b>VII. Requirements for obtaining loans:</b></p> <p>Fully master the theoretical and methodological concepts of the subject, be able to correctly reflect the results of the analysis, conduct independent observations of the processes and concepts being studied, and complete the tasks and assignments given in the current and intermediate control forms, and pass the final control test.</p>
6.	<p><b>Main literature</b></p> <ol style="list-style-type: none"> <li>1. Mirkhamidova R., Vakhabov AX, Davranov K., Tursunboeva GS “Fundamentals of Microbiology and Biotechnology”. Tashkent: Ilm Ziyo. 2014. -225 p.</li> <li>2. Muhammedov I “Fundamentals of Microbiology and Virology ”. Textbook “New Age Generation” T – 2019</li> </ol>

<p>3. Mustakimov G. "Fundamentals of Plant Physiology and Microbiology" textbook "Teacher" Tashkent – 1995</p> <p>4. Yusupov I "Laboratory exercises in general microbiology" textbook "Science and science" Tashkent – 2023</p>
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**Additional literature**

1. Khodzhitdinova M. Water Chemistry Microbiology "New Edition" Textbook T – 2010
2. Muhammedov I et al., Fundamentals of Microbiology and Biotechnology "Ilm ziya" textbook T – 2014

**Information sources**

<http://www.ziyonet.uz/>