

Summary of the working program of the academic discipline
«MICROBIOLOGY»

General Educational Program of higher education **PHARMACY 05.33.01**

Department: **EPIDEMIOLOGY, MICROBIOLOGY AND EVIDENCE-BASED MEDICINE**

1. The purpose of mastering the discipline (participation in forming the relevant competencies UC-1, 6, 8, GPC-1, 2).

2. Position of the academic discipline in the structure of the General Educational Program (GEP).

2.1. The discipline "**Microbiology**" refers to the core part of Block 1 of GEP HE ((B1.O.18)). The discipline is taught in 2 and 3 semester/ I and II year of study.

3. Deliverables of mastering the academic discipline and metrics of competence acquisition

Mastering the discipline aims at acquiring the following universal (UC) or/and general professional (GPC) or/and professional (PC) competencies

n/a	Competence code	The content of the competence (or its part)	Code and name of the competence acquisition metric	As a result of mastering the discipline, the students should:		
				know	be able to	possess
1.	UC-1	UK-1. Able to realize critical analysis of problem situations based on a systematic approach, develop strategy actions	UC-1.1. Analyzes the problem situation as a system identifying its components and connections between them UC-1.2. Identifies gaps in the information needed to solve a problem situation, and designs processes for their elimination UC-1.3. Critically assesses reliability of information sources, works with conflicting information from different sources UC-1.4. Develops and meaningfully argues the strategy of solving the problem situations based on the system and interdisciplinary approaches UC-1.5. Uses logical and methodological tools for critical evaluation of modern	Safety regulations and work in biological laboratories, with reagents, devices, animals; Principles of sterilization, disinfection and antiseptic treatment of tools and equipment Types of infection; the role of microbes in the development of the infectious process; mechanisms and pathways of pathogen transmission	Apply safety and work regulations in biological laboratories, with reagents, devices, animals and principles of sterilization, disinfection and antiseptic treatment of instruments and equipment for the analysis of a problem situation	Rules of safety and work in biological laboratories and principles of sterilization, disinfection and antiseptic treatment of instruments and equipment for the development of measures to prevent infection

			concepts of philosophical and social nature in its subject areas			
2.	UC-6	Able to determine and implement the priorities of own activities and ways to improve it on the basis of self-assessment and lifelong education	<p>UC-6.1. Evaluates its resources and their limits (personal, situational, temporary), optimally uses them for successful execution of the assigned task</p> <p>UC-6.2. Determines the priorities of professional growth and ways to improve their own activities based on self-assessment according to the selected criteria</p> <p>UC-6.3. Builds a flexible professional trajectory using the tools of continuing education, taking into account the accumulated experience of professional activity and dynamically changing labor market requirements</p>	The influence of microorganisms on human health, mechanisms and ways of transmission of pathogens, pathogenesis, the main clinical manifestations of diseases. The main immunological methods for assessing the impact of the environment on human health	Apply basic immunological methods for assessing the impact of the environment on human health to analyze the problem situation	Skills of self-preparation for classes, search for additional information on behalf of the teacher, use self-control methods.
3.	UK-8	UC-8. Able to create and support in everyday life and in professional activity, safe living conditions for the preservation of the natural environment, ensuring the sustaina-	<p>UC-8.1. Analyzes the factors of harmful influence on the vital activity of the elements of the habitat (technical means, technological processes, materials, buildings and structures, natural and social phenomena)</p> <p>UC-8.2. Identifies dangerous and harmful factors within the framework of the activity</p> <p>UC-8.3. Solves problems related to safety violations and participates in prevention</p>	<p>Methods of microbiological diagnostics of human infectious diseases.</p> <p>The main groups of antimicrobial chemotherapeutic and immunobiological drugs.</p> <p>Sanitary microbiology.</p> <p>The concept of "biological safety".</p> <p>Methods for assessing the biological safety of</p>	To carry out sampling, labeling and arrange for the direction of biological material from the patient and habitat objects for microbiological examination. Evaluate and	<p>Skills of sanitary and educational work.</p> <p>Skills of making a preliminary diagnosis based on the results of laboratory and instrumental examination in order to recognize and assess dangerous situations, envi-</p>

		ble development of society, including in case of threat and occurrence of emergency situations and military conflicts	activities of emergencies in the workplace UC-8.4. Observes and explains rules of conduct in the event of emergencies of natural and man-made origin, provides first aid	environmental objects and industrial products.	interpret research results in order to create and maintain safe living conditions	ronmental risk factors affecting the health of a population or individual groups of the population
4.	GPC-1	GPC-1. Able to use basic biological, physical-chemical, chemical, mathematical methods for the development, research and examination of medicines, the manufacture of medicinal products	GPC-1.1. Applies basic biological methods of analysis for the development, research and examination of pharmaceuticals and medicinal plant raw materials GPC-1.2. Applies basic physical-chemical and chemical analysis methods for the development, research and examination of medicinal products and medicinal plant raw materials GPC-1.3. Applies the basic methods of physical-chemical analysis in the manufacture of medicinal products GPC-1.4. Applies mathematical methods and performs mathematical processing of data obtained during the development of medicines, as well as research and examination of medicines and medicinal plant raw materials	Classification, morphology and physiology of microbes, their indication and identification. The concept of "immunity" as immunity to infectious diseases; Types of infectious immunity; nonspecific and specific protection factors in bacterial and viral infections;	To carry out a microscopic examination of the material, its sowing on nutrient media, to determine morphological, tinctorial, cultural, antigenic, genetic and biochemical properties, to carry out serological and genetic diagnostics.	Skills in choosing specialized equipment, technology, drugs and products, disinfectants, medicines, other substances and their combinations based on the set professional task
5.	GPC-2	GPC-2. Able to apply knowledge about morphofunc-	GPC-2.1. Analyzes the pharmacokinetics and pharmacodynamics of medicines based on knowledge about morphofunctional features,	Classification of antibiotics by chemical structure, producers, mechanism of action, spectrum	To analyze the effectiveness of antibiotics by the	Skills of independent work with educational and scientific litera-

	<p>tional features, physiological conditions and pathological processes in the human body to solve professional tasks</p>	<p>physiological conditions and pathological processes in the human body GPC-2.2. Explains the main and side effects of drugs, the effects of their combined use and interaction with food, taking into account morphofunctional features, physiological conditions and pathological processes in the human body GPC-2.3. Takes into account morphofunctional features, physiological conditions and pathological processes in the human body when choosing non-prescription medicinal products and other pharmacy products</p>	<p>of action. The principle of inhibition of bacterial growth, the most important targets for antibacterial drugs. Pharmacokinetics and pharmacodynamics of the drug in the human body, possible consequences and side effects of antibiotics. The mechanism of the main immune reactions used for the diagnosis of infectious diseases; diagnostic drugs; immunobiological drugs for prevention</p>	<p>disco-diffusion method. Determine the minimum inhibitory and bactericidal concentrations of the antibiotic. Keep records of the antibiogram.</p>	<p>ture, the Internet for solving professional tasks Skills interpretation of these basic concepts and methods in solving a professional problem</p>
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4. Volume of the academic discipline and types of academic work

Total labor intensity of the discipline is 6 CU (216 AH)

Type of educational work	Labor intensity		Labor intensity by semester (AH)	
	volume in credit units (CU)	volume in academic hours (AH)	2	3
Classroom work, including	3,05	110	66	44
Lectures (L)		32	18	14
Laboratory practicum (LP)*		78	48	30
Practicals (P)	are not provided			
Seminars (S)	are not provided			
Student's individual work (SIW)	1,95	70	42	28
Mid-term assessment exam	1	36	-	36
TOTAL LABOR INTENSITY	6	216	108	108

5. Sections of the academic discipline and competencies that are formed

№	Competence code	Section name of the discipline	The content of the section in teaching units
1.	UC-1, 6, 8, GPC-1, 2	Morphology and metabolism of	The subject and tasks of medical microbiology, virology. Discoveries of A. Leeuwenhoek, L.Pasteur, R. Koch. The relationship of microbiology with other disciplines. The importance of microbiology, virology in the preparation of a

		bacteria	<p>doctor. Systematics of microbes. The concepts of species, strain, culture, clone, population.</p> <p>Morphology of microbes. The main signs of a prokaryotic cell. Ultrastructure and chemical composition of bacteria. Differences in the structure of gram-positive and gram-negative bacteria. Chemical composition, structure and role of capsules and spores. Protoplasts, spheroplasts, L-forms of bacteria and mycoplasma.</p> <p>Various methods and techniques of microscopic examination of bacteria. Simple and complex ways of painting strokes. Gram staining of bacteria, mechanism and practical significance. Detection of spores and capsules in bacteria. The importance of the microscopic method in the diagnosis of diseases.</p> <p>The physiology of microbes. Constitutive and inducible bacterial enzymes. Mechanisms of nutrient intake into the prokaryotic cell. Catabolism and anabolism in aerobic and anaerobic bacteria.</p> <p>Characteristics of the growth and reproduction processes in bacteria. Characteristics of the bacteriological research method. Nutrient media. Pure cultures and their production. Stages of the bacteriological research method. Methods of identification of the isolated culture, determination of its sensitivity to antibiotics. Methods of cultivation of aerobic and anaerobic bacteria.</p>
2.	UC-1, 6, 8, GPC-1, 2	Antibiotics	<p>Symbiosis and antibiosis. Antibiotics. The history of discovery. Classification by origin, chemical composition. Narrow and wide spectrum, bacteriostatic and bactericidal action. The mechanism of action of antibiotics on prokaryotic cells. Bacteriocins.</p>
3.	UC-1, 6, 8, GPC-1, 2	General virology	<p>Viruses. Basics of classification. History of virology development. Hypotheses about the origin and nature of viruses. The fundamental differences between viruses and prokaryotic cells. Modern principles of classification and nomenclature of viruses. Features of the structural organization of viruses. Ecology of viruses. The concept of a virus and a virion. Viroids and prions, their role in pathology. Stages of virus-cell interaction. Methods of virus cultivation.</p> <p>Molecular bases of virus reproduction. Features of reproduction of RNA viruses (plus-RNA viruses, minus-RNA viruses), DNA viruses, retroviruses. Outcomes of virus-cell interaction. Productive, abortive and integrative infections. Persistence of viruses. Mechanisms and types of persistence. Virogenia. Methods of studying viruses. Bacteriophages. Classification, mechanisms of interaction of a bacteriophage with a cell. Lysogeny. Concepts of profage. Practical significance of phages in biology and medicine.</p>
4.	UC-1, 6, 8, GPC-1, 2	Ecology microorganisms. Sanitary microbiology	<p>The spread of microbes in the environment. The role of microbes in the circulation of substances in nature.</p> <p>The purpose and objectives of sanitary microbiology, the objects to be studied. The main regulatory documents of sanitary and bacteriological studies are the microflora of the environment (water, soil, air) and its role in the development of human diseases. Sanitary-indicative microorganisms, methods of their determination. Standards for the evaluation of distilled water (for the preparation of medicines, injection solutions), drinking water, open reservoirs, underground sources, wastewater. Criteria for assessing microbial contamination of pharmacy air.</p> <p>Sanitary-bacteriological examination of dishes and equipment of pharmacies. Basic documents on microbiological control of pharmacies. The importance of sanitary and microbiological research in assessing the state of pharmacies.</p> <p>The microflora of the human body (skin, mucous membranes of the gastrointestinal tract, respiratory and genitourinary systems), its role in norm and pathology. Autochthonous and allochthonous microflora. Dysbiosis. Factors af-</p>

			<p>fecting the composition of microflora. Preparations for the restoration of intestinal microflora (eubiotics). Sanitary and bacteriological examination of hand washes.</p> <p>Plant microflora, phytopathogenic microorganisms. Epiphytic microflora. Diseases of medicinal plants caused by phytopathogenic bacteria, viruses, fungi. The role of microflora in the spoilage of herbal medicinal raw materials and medicines (solid, liquid, soft). Sources and ways of microbial contamination and ways to prevent them.</p> <p>Microbiological examination of medicinal raw materials and finished medicines. Methods of microbiological control of medicines in pharmacies. Destruction of microbes in the environment. Disinfection. The principle of decontamination.</p> <p>The concepts of disinfection and sterilization. Aseptics and antiseptics. Physical and chemical factors of decontamination. The concept of antiseptics, disinfectants. Methods for monitoring the effectiveness of sterilization and disinfection.</p>
5.	UC-1, 6, 8, GPC-1, 2	<p>Infectious process.</p> <p>Pathogenicity and virulence.</p> <p>Bacteria genetics</p>	<p>Characteristics of pathogenicity factors. Factors determining adhesion, colonization, invasion, the doctrine of biofilms. Biofilms and mechanisms of their formation. Comparative characteristics of exo- and endotoxins of bacteria. Genetic control of pathogenicity factors in microbes. The role of plasmids.</p> <p>The doctrine of the infectious process. Stages of the infectious process. Exogenous and endogenous, primary and secondary infection. Bacteriocarriage.</p> <p>The role of the external environment in the infectious process. Ways of transmission of infectious diseases. Pathogenicity factors of microorganisms.</p> <p>The structure of the bacterial genome. Genotype and phenotype in prokaryotes. Modern ideas about the mechanisms of replication of chromosomal DNA in bacteria. The role of plasmids and other mobile genetic elements in the vital activity of bacteria. Characteristics of the main forms of variability.</p> <p>Phenotypic and genotypic variability. Modifications and mutations.</p> <p>Types of recombinant variability in bacteria. Characterization of the processes of transformation, conjugation, transduction and lysogenic conversion.</p> <p>The role of different types of variability in the evolution of bacteria. Mechanisms of the emergence and spread of drug resistance at the cell and population level. R-plasmids and their role in stability. Practical significance of phages in biology and medicine. Genetic engineering and biotechnology.</p>
6.	UC-1, 6, 8, GPC-1, 2	General immunology	<ol style="list-style-type: none"> 1. Introduction to immunology. Subject, tasks, methods of immunology. Historical information. The structure of the immune system. Types of immunity. 2. Antigens. Structure and functions of antigens. Bacterial and viral antigens. 3. Antibodies. Structure and functions of antibodies. Classes of immunoglobulins. 4. Antigen-recognizing T- and B-lymphocyte receptors. Building. Functions. Natural killers. 5. Antigens of the main histocompatibility complex. Presentation of antigens. Regulation of T- and B-cell immunity. 6. Induction of the immune response. Cytokines. 7. Implementation of the immune response. Cooperation of factors of specific and nonspecific immunity. 8. Anti-infectious immunity. Levels of protection against infection. 9. Vaccines and serums. Serological reactions. The immune status of the organism and methods of its assessment.
7.	UC-1, 6, 8, GPC-1, 2	Special medical micro	1. Methods of laboratory diagnostics of infectious diseases of microbiological research (express diagnostics, microbiological and immunological).

		biology	<p>2. Pyogenic cocci. Staphylococci. Streptococci. Meningococci. Gonococci. Classification. Characteristic. Role in pathology. Immunity. Laboratory diagnostics. Treatment and prevention.</p> <p>3. <i>Enterobacteriaceae</i> family. Escherichia. Shigella. Salmonella. Taxonomy and classification. Morphology and other biological properties. Pathogenesis and clinic of the diseases caused. Immunity. Prevention. Nosocomial infections caused by enterobacteria.</p> <p>4. Causative agents of diphtheria. Biological properties. Pathogenesis and clinic of the diseases caused. Immunity. Specific prevention.</p> <p>5. Mycobacterium tuberculosis. Characteristic. Pathogenesis and clinic of tuberculosis. Immunity. Specific prevention.</p> <p>6. The causative agent of anthrax. Pathogenesis and clinic of the diseases caused. Ecology of pathogens. Specific prevention.</p> <p>7. Pathogenic clostridia. Pathogens of tetanus, anaerobic wound infection, botulism. Ecology of pathogens. Pathogenesis and clinic of the diseases caused. Specific therapy and prevention of clostridiosis.</p> <p>8. Mycoplasma. Chlamydia. Features of morphology, physiology. Pathogenesis and clinic of the diseases caused. Prevention.</p>
8.	UC-1, 6, 8, GPC-1, 2	Special medical virology	<p>1. Orthomyxoviruses. The flu virus. Structure and other biological properties. The pathogenesis of influenza. Immunity. Diagnostics. Specific prevention.</p> <p>2. The concept of ARVI. Paramyxoviruses. Adenoviruses. Characteristic. Prevention.</p> <p>3. Rhabdoviruses. Rabies virus. Biological properties and ecology. Role in human pathology. Prevention.</p> <p>5. Picornaviruses. Polio virus. Pathogenesis and clinic of polio. Specific prevention. Coxsackie viruses, ESCO – pathogens of polio-like diseases.</p> <p>6. Human immunodeficiency virus (HIV). Pathogenesis and clinic of the disease. Diagnostics. Prevention.</p> <p>7. Human herpesviruses. Herpes simplex virus. Primary and recurrent herpes. Chickenpox virus – shingles. Cytomegalovirus. Pathogenesis and clinic of the diseases caused. Diagnostics. Prevention.</p> <p>8. Hepatitis viruses. Hepatitis A virus. Hepatitis B virus. Pathogenesis and clinic of viral hepatitis. Immunity. Prevention. 9. Arboviruses. Tick-borne encephalitis virus. 10. Rotaviruses.</p>