Ministry of Health of the Russian Federation
Federal State Budgetary Educational Institution
Higher education
"DAGESTAN STATE MEDICAL UNIVERSITY"

(FSBEI HE DSMU of the Ministry of Health of Russia)

APPROVES
Vice-Rector for Academic Affairs
Doctor of Medical Sciences, Professor
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WORK PROGRAM OF THE DISCIPLINE "IMMUNOLOGY"

Discipline index – **B1. О.2 6**
Direction of training (specialty) - **31.05.01 General Medicine**
Level of higher education **specialist**
Qualification of the graduate - **medical doctor**
Faculty **of Medical**
Department of **Microbiology, Virology and Immunology**
Form **of full-time** education
course - **2**
semester **- IV**
Total labor intensity **3 z.u./ 108 hours**
Lectures **- 18 hours**
Practical (seminar) classes - **54 hours**
Independent work - **36 hours**
Form of control credit in the **IV** semester

Makhachkala 2022

The work program of the discipline "Immunology" was developed in accordance with the Federal State Educational Standards of Higher Education in the direction of training (specialty) 31.05.01 General Medicine, approved by the order of the Ministry of Education and Science of the Russian Federation No. 988 of August 12, 2020.

The work program of the discipline was approved at the meeting of the department

of "29" June 2022 Minutes No. 18

The work programme has been agreed upon:

1. Director of NMB DSMU _____ Musaeva V.R.
2. MR KKO _____ Karimova A.M.
3. Dekan _____ Savzhikhanov R.T.

Head of the Department – Doctor of Biological Sciences, Professor S.M. Omarova

Developer(s) of the work program:

1. Omarova S.M. - Doctor of Biological Sciences, Professor, Head of the Department of Microbiology, Virology and Immunology
2. Isaeva R.I. – Associate professor of the Department of Microbiology, Virology and Immunology
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Reviewers:

1. Saidov M.Z. – Associate professor, training directorof the Department pathological physiology
2. Korkmasova M.A. – Associate professor of the Department of Microbiology, Virology and Immunology

I. THE PURPOSE AND OBJECTIVES OF MASTERING THE DISCIPLINE

Purpose: formation of students' modern ideas about the structure and function of the immune system, the nature of immunopathology in patients of different ages, etiology, pathogenesis, methods of clinical, instrumental and laboratory diagnostics, as well as treatment and prevention of immunodeficiency states and allergopathology.

Tasks:

- formation of knowledge about the structure and function of the human immune system, its age characteristics, cellular and molecular mechanisms of development and functioning of the immune system, the main stages, types, genetic control of the immune system from theveta, methods of immunodiagnostics;
- formation of knowledge and skills in the application and evaluation of the results of laboratory research methods in immunodeficiency states, allergic and other immune-mediated diseases;
- formation of knowledge about primary immunodeficiencies, HIV infection, AIDS and other secondary immunodeficiency states;
- formation of knowledge about blood groups and methods fordetermining the gram upp affiliation of ABO and Rh;
- formation of knowledge about hypersensitivity, its classification according to Coombs-Jell, the etiology and pathogenesis of I-V types of hypersensitivity, the principles of laboratory diagnostics;
- formation of knowledge about transplantation immunity, the principles of selecting a donor and recipient, graft rejection reactions.
- Formation of knowledge about tolerance and autoimmunity.
- formation of knowledge about antitumor immunity.

II. PLANNED RESULTS OFTRAINING IN THE DISCIPLINE

Competencies formed in the process of studying the discipline

Competence code and name (or parts of it)	**Code and name of the competency achievement indicator**
General Professional Competencies (GPC)	
GPC-5 Is able to assess morpho-functional, physiological states and pathological processes in the human body to solve professional problems	ID-1 GPC-5 Evaluates morpho-functional processes in physiological conditions
know: systematics, classification, structure, physiology, genetics of the immune system; basic patterns and mechanisms of development of the immune response, the role of innate and acquired immunity in physiological immune reactions, ways of implementing the immune response in the human body outside pathological conditions; the influence of specific and nonspecific factors on the morphofunctional development and physiological processes of the immune system of the human body in different age periods. **be able** to: identify and analyze the patterns of indicators of immune status in the norm in different age groups; conduct immunoprophylactic measures among the population in order to create active acquired immunity; **possess:** knowledge in the field of immunology, molecular and cellular immunology and is able to apply them in the study of the body's response in response to a viral infection, the mechanisms of formation of an antiviral immune response; onthe national vaccination calendar.	

	ID-2 GPC-5 Evaluates morpho-functional processes in pathological conditions
know: systematics, classification, structure, pathology, genetics of the immune system; basic patterns and mechanisms of development of the immune response, the role of innate and acquired immunity in the development of the infectious process, ways of implementing the immune response in the human body; the influence of specific and nonspecific factors on the morphofunctional state and pathological processes of the immune system of the human body in different age periods; **be able** to: identify and analyze patterns of changes in immune status indicators in various immunopathologic conditions; conduct immunological methods for diagnosing immunodeficiency states and infectious diseases; **possess:** skills in assessing and interpreting the results of immunological research methods in the diagnosis of infectious diseases.	

III. PLACE OF DISCIPLINE IN THE STRUCTURE OF THE EDUCATIONAL PROGRAM

The discipline "Immunology" refers to the mandatory part B1.O.26 according to the curriculum of the specialty 31.05.01 General Medicine.

The antecedents, on which the discipline "Immunology" is directly based, are "History of Medicine", "Latin Language", "Biology, Ecology", "Histology, Embryology, Cytology", "Biological Chemistry", "Pharmacology", "Pathological Physiology".

The discipline "Immunology" is fundamental for the study of the following disciplines: "Clinical Immunology", "Public Health and Public Health", "Military Hygiene", "Clinical Laboratory Diagnostics", "General Hygiene, Social and Hygienic Monitoring", "Infectious Diseases, Parasitology".

The development of competencies in the process of studying the discipline contributes to the formation of knowledge, skills and abilities that allow for effective work on the implementation of the following types of tasks of professional activity:

Medical activities:

- Prevention of the occurrence of diseases among the population through preventive and anti-epidemic measures;
- diagnostics of diseases and pathological conditions;
- Participation in the provision of emergency medical care to children in conditions requiring urgent medical intervention;

Research:

- analysis of scientific literature and official statistical reviews, participation in statistical analysis and public presentation of the results obtained;
- participation in solving certain research and scientific-applied problems in the field of health care in diagnosis, treatment, medicalrehabilitation and prevention.

IV. SCOPE OF DISCIPLINE AND TYPES OF EDUCATIONAL WORK

The total labor intensity of the discipline is 3 credits

Type of educational work	Total hours	Semester
		4
Contact work of students with the teacher	72	72
Classroom classes (total)	72	72
Including:		
Lectures (L)	18	18
Practical exercises (PE)	54	54
Laboratory classes (LC)		
Independent work of the student (IWS)	36	36
Type of intermediate attestation (offset)	Credit	Credit
Total labor intensity:		
hours of credits	108 3	108 3

V. CONTENTOF THE WORK PROGRAM OF DISCIPLINES

5.1. Sections of the discipline and competence that are formed during their study

№ Section	Namingof the discipline section	Contents	Supervised competency code (or part of it)
1	2	3	4
1.	**Immunity. Types of immunity.**	The subject and tasks of immunology. The connection of the subject with other disciplines. History of Immunology. The term "immunity" (from the Latin. immunitas (exemption from something, immunity) was used already in the Middle Ages when freeing, for example, peasants from taxes, and in our time it has found use among diplomats (diplomatic immunity, i.e. immunity). The main function of the immune system is to recognize the antigen, i.e. to establish its genetic foreignness, genetic difference from its own antigens, and a complex of reactions and mechanisms inherent in the immune system, to eliminate its influence on the biological processes occurring in the body, in order to preserve homeostasis, the structural and functional integrity of the body, and also to preserve the specific memory of this antigen, sometimes for life.	ID-1 GPC-5

		In the modern sense, immunology is not only a science that studies protection against infectious diseases. Immunology is one of the branched sciences, has many directions and sections that have formed almost into independent disciplines, covering both theoretical, fundamental, and preventive and clinical problems of medicine: vaccinology, allergology, immuno-oncology, immunopathology, reproduction immunology, transplantation immunology, immunopharmacology, clinical and environmental immunology. Types of immunity are as follows. 1. Hereditary immunity (congenital, or species) is detected already at birth and is a genotypic trait that is inherited. It can be species and individual. Species immunity is the immunity of one species of animals or humans to microorganisms that cause diseases in other species. It is genetically determined in humans as a biological species, that is, a person does not suffer from zoonotic diseases. 2. Acquired immunity is called such immunity of the human body to infectious agents, which is formed in the process of its individual development and is characterized by strict specificity. It is always individual, not inherited, and can be natural and artificial. Artificial acquired immunity occurs during immunization (vaccination). Artificial immunity can be created actively and passively. Active is formed by the introduction of antigenic drugs, vaccines, toxoids. Passive immunity is formed by the introduction of ready-made serums and immunoglobulins, i.e. ready-made antibodies. Non-specific protection factors (species immunity) include:	

		mechanical (anatomical: skin and mucous membranes of the respiratory tract, gastrointestinal tract, atrial fibrillation and mucus of the respiratory tract), barrier function of lymph nodes; normal microflora of the body; physicochemical (enzymes, primarily the gastrointestinal tract; reaction of the medium; organic acids, etc.), which ensure the destruction of antigens; nonspecific immunobiological protection carried out by normal immune cells and humoral components (phagocytosis, normal killers, complement system, inflammation, interferon, coagulation inhibitors, fibronectin, fever, main histocompatibility system). Specific factors (acquired immunity) include: antibody formation; immune phagocytosis and killer function of immune macrophages and lymphocytes; immediate hypersensitivity; delayed type hypersensitivity; immunological memory; immunological tolerance. Both of those and other defense factors function in interaction and constitute a single system of protection of the body from antigens. At the same time, they can be included in the protection process not at the same time and not all at once. Depending on the nature of the antigenic effect, one or more forms of response may be leading.	
2.	**Immune system. Immunocompetent cells.**	The immune system is a set of organs, tissues and cells that ensure the cellular-genetic constancy of the body. The human immune system provides specific protection of the body from genetically foreign molecules and cells, including infectious agents - bacteria, viruses, fungi, protozoa. The principles of antigenic (genetic) purity are based on the recognition of "own - alien" and are largely due to the system of genes and	ID-1 GPC-5

		glycoproteins (products of their expression) - the main histocompatibility complex (MHC), in humans often called the HLA system (human leukocyte antigens). Central and peripheral organs of the immune system Central (primary): bone marrow - hematopoietic organ, thymus gland or thymus, lymphoid tissue of the intestine are places of differentiation of lymphocyte populations. Neriferic (secondary): spleen, lymph nodes, tonsils, accumulations of lymphoid tissue in their own layer of mucous membranes of the intestinal type (lymphoid tissue associated with the intestines and bronchi) the organs of immunity are populated by B- and T-lymphocytes from the central organs of the immune system; after contact with the antigen in these organs, lymphocytes are included in recirculation. Progenitor cells of immunocompetent cells are produced by the bone marrow. Some descendants of stem cells become lymphocytes. Lymphocytes are divided into two classes - T and B. In the bone marrow, progenitor cells mature for various populations of B-lymphocytes and macrophages, specific immune reactions occur in it. It serves as the main source of serum immunoglobulins. In birds, immature B cells migrate to Fabricius' pouch (bursa), where they reach maturity. The spleen is colonized by lymphocytes in the late embryonic period and after birth. In the white pulp there are thymus-dependent and thymus-independent zones, which are populated by T-B lymphocytes. Mature B- and T-lymphocytes colonize peripheral lymph nodes.	

		Lymphocytes enter the lymph nodes through afferent lymphatic vessels. The movement of lymphocytes between tissues, the bloodstream and lymph nodes allows antigen-sensitive cells to detect antigen and accumulate in those places where the immune reaction occurs, and the spread of memory cells and their descendants throughout the body allows the lymphoid system to organize a generalized immune response. Lymphocytes have a common morphological characteristic, but their functions, superficial CD (from cluster differentiation) markers, individual (clonal) origin, are different. According to the presence of superficial CD markers, lymphocytes are divided into functionally different populations and subpopulations, primarily into T- (thymus-dependent, which have undergone primary differentiation in the thymus) lymphocytes and B- (bursa-dependent, maturing in the bag of Fabricius in birds or its analogues in mammals - in the bone marrow in humans) lymphocytes. Localization. T-lymphocytes arise in the embryonic thymus. In the postembryonic period after maturation, T-lymphocytes settle in T-dependent zones of peripheral lymphoid tissue (periarticular in the white pulp of the spleen and paracortical zones of the lymph nodes). After stimulation (activation) of a certain antigen, T-lymphocytes are converted into large transformed T-lymphocytes, from which the executive link of T cells then arises. Functions T-lymphocytes recognize the antigen-representing (A) cells processed and presented on the surface. They are responsible for cellular immunity, cell-type immune responses. Individual subpopulations help B lymphocytes	

		respond to T-dependent antigens by producing antibodies (regulate the activity of B cells). They are involved in delayed (IV) type hypersensitivity. The formation and maturation of immunocompetent cells is carried out in the central organs of immunity (for T-lymphocytes - in the thymus). T-lymphocyte progenitor cells enter the thymus, where pre-T cells (thymocytes) mature, proliferate and undergo differentiation into separate subclasses as a result of interaction with epithelial and dendritic stroma cells and exposure to hormone-like polypeptide factors secreted by thymus epithelial cells (alpha1-thymosin, thymopoietin, thymulin, etc.). When differentiated, T lymphocytes acquire a certain set of membrane CD markers. T cells are subpopulated according to their function and CD marker profile. T lymphocytes recognize antigens using two types of membrane glycoproteins, T cell receptors (a family of Ig-like molecules) and CD3, which are non-covalently linked together. Their receptors, unlike antibodies and B lymphocyte receptors, do not recognize freely circulating antigens. They recognize the peptide fragments presented to them by A cells through a complex of foreign substances with the corresponding protein of the main histocompatibility system of class 1 and 2. The main function of B cells is differentiation as a result of antigenic stimulation into plasma cells that produce antibodies, i.e. effector participation in humoral immune reactions. There are several subtypes of B-lymphocytes. The formation of B-cells in the fetus occurs in the liver, in the future - in the bone marrow.	

3.	**Antigens. Classification. Properties.**	Antigens have a number of characteristic properties: antigenicity, specificity and immunogenicity. Antigens can be proteins, polysaccharides and nucleic acids in combination with each other or lipids. Antigens are any structures that carry signs of genetic foreignness and are recognized as such by the immune system. Protein antigens, including bacterial exotoxins, viral neuraminidase, have the greatest immunogenicity. Diversity of the concept of "antigen". Antigens are divided into complete (immunogenic), always exhibiting immunogenic and antigenic properties, and incomplete (haptens), unable to independently cause an immune response. Haptens have antigenicity, which determines their specificity, the ability to selectively interact with antibodies or lymphocyte receptors, to be determined by immunological reactions. Haptens can become immunogenic when bound to an immunogenic carrier (e.g., a protein), i.e., become complete. The hapten part is responsible for the specificity of the antigen, the carrier (more often protein) is responsible for immunogenicity. Immunogenicity depends on a number of reasons (molecular weight, mobility of antigen molecules, shape, structure, ability to change). Of significant importance is the degree of heterogeneity of the antigen, i.e. foreignness to a given species (macroorganism), the degree of evolutionary divergence of molecules, the uniqueness and unusualness of the structure. Foreignness is also determined by the molecular weight, size and structure of the biopolymer. its macromolecularity and rigidity of structure.	ID-1 GPC-5

		The antigenicity of proteins is a manifestation of their foreignness, and its specificity depends on the amino acid sequence of proteins, secondary, tertiary and quaternary (i.e., on the general conformation of the protein molecule) structure, on superficially located determinant groups and terminal amino acid residues. Colloidal state and solubility are mandatory properties of antigens. The specificity of antigens depends on special regions of protein molecules and polysaccharides called epitopes. Epitopes or antigenic determinants are fragments of antigen molecules that cause an immune response and determine its specificity. Antigenic determinants selectively react with antibodies or antigen-recognizing receptors of the cell. Epitopes can differ qualitatively, "their" antibodies can be formed to each. Antigens containing one antigenic determinant are called monovalent, - a number of epitopes - polyvalent. Polymer antigens contain a large number of identical epitopes (flagellins, LPS). The main types of antigenic specificity (depend on the specificity of the epitopes). 1. Species - characteristic of all individuals of the same species (common epitopes). 2. Group - within the species (isoantigens, which are characteristic of individual groups). An example is blood groups (ABO, etc.). 3. Heterospecificity - the presence of common antigenic determinants of organisms of various taxonomic groups. There are cross-reacting antigens in bacteria and tissues of the macroorganism. a) Forsmann antigen - a typical cross-reacting antigen, detected in the erythrocytes of cats, dogs, sheep, guinea pig	

		kidney; In humanIWh antigens agglutinate antibodies to monkey erythrocytes Macacus rhesus, i.e. are cross-linked; c) common antigenic determinants of human erythrocytes and plague bacilli, smallpox and influenza viruses are known; d) another example is protein A streptococcus and myocardial tissue (valve apparatus). 4. Stage-specificity. There are antigens characteristic of certain stages of development associated with morphogenesis. Alpha-fetoprotein is characteristic of embryonic development, synthesis in adulthood increases dramatically in liver cancer. Flagella, or H-Ag, are localized in the locomotor apparatus of bacteria - their flagella. They are epitopes of the contractile protein - flagellin. When heated, flagellin denatures (thermolabile), and H-Ag loses its specificity. Phenol does not act on this Ag. Somatic, or O-Ag, is associated with the cell wall of bacteria. It is based on LPS, it is thermally stable - it is not destroyed by prolonged boiling (in Gr- bacteria, specificity is determined by deoxysaccharides of LPS polysaccharides). However, somatic Ag is subject to the action of aldehydes (formalin), alcohols that violate its structure. If the animal is immunized with live bacteria that have flagella, then AT will be produced, directed simultaneously against O- and H-Ag. The introduction of boiled culture stimulates the biosynthesis of AT to somatic O-Ag. A culture of bacteria treated with phenol will cause the formation of AT only to flagella ah. Lipid A (part of the cell wall of G- bacteria) is a heterodimer; contains glucosamine and fatty acids. It has a strong adjuvant, nonspecific immunostimulating activity and toxicity.	

		Histocompatibility antigens. In organ transplants, there is a problem of tissue compatibility associated with the degree of their genetic relationship, rejection reactions of foreign allogeneic and xenogenic grafts, i.e. problems of transplantation immunity. There are a number of tissue antigens. Transplantation antigens largely determine the individual antigenic specificity of the body. The HLA system is a system of strong antigens. The spectrum of MHC molecules is unique to the body, which determines its biological individuality and allows it to distinguish between the "foreign-incompatible". The seven genetic loci of the system are divided into three classes. Class One genes control the synthesis of Class 1 antigens, identify tissue antigens, and control histocomposomessity. Class 1 antigens determine individual antigenic specificity, they represent any foreign antigens to T-cytotoxic lymphocytes. Class 1 antigens are present on the surface of all nucleated cells. Class 1 MHC molecules interact with the CD8 molecule expressed on the cytotoxic lymphocyte precursor membrane ("CD" – claster difference). MHC Class 2 genes control class 2 antigens. They control the response to thymus-dependent antigens. Class 2 antigens are expressed primarily on the membrane of the immuof nocompetent cells (primarily macrophages and B lymphocytes, partially activated T lymphocytes). The same group of genes (more precisely, the HLA-D region) also includes the genes of the 1g-strength of the immune response and the genes of the Is-cynpeccuu immune response. MHC class 2 antigens provide interaction between macrophages and B lymphocytes, are involved in all	

		stages of the immune response - the presentation of the antigen by macrophages to T-lymphocytes, the interaction (cooperation) of macrophages, T and B lymphocytes, the differentiation of immunocompetent cells. Class 2 antigens are involved in the formation of antimicrobial, antitumor, transplantation and other types of immunity.	
4.	**Endogenous immunoregulators. Cellular and humoral immunity.**	Cytokines. One of the features of immunocompetent cells, especially T-lymphocytes, is the ability to produce a large number of soluble substances - cytokines (interleukins), which carry out regulatory functions. They ensure the coordinated work of all systems and factors of the immune system, thanks to direct and feedback between different systems and subpopulations of cells, provide stable self-regulation of the immune system. Cytokines are also involved in the regulation of apoptosis, in proliferation, angiogenesis and other cellular processes. Views were formed on a single cytokine system that combines interferons, interleukins, colony-stimulating factors and other growth factors and is of great importance in ensuring the homeostasis of the body. Their determination (cytokine profile) gives an additional idea of the state of the immune system. In general, the homeostasis of the body is provided by the coordinated work (interaction) of the immune, endocrine and nervous systems. Cytokines are secreted by various cells (lymphocytes, macrophages, etc.) in the process of intercellular interaction in response to antigenic irritation (infectious agent) and normally direct the immune response along the most effective pathway. According to the profile of action, cytokines can be divided into pro-inflammatory and anti-inflammatory, according to the	ID-1 GPC-5

		predominant orientation of the immune response -Th1 (T-helper l - aimed at the formation of a cell-mediated immune response) and Th2 (mainly humoral). Balance of Thl / Th2 cytokines in the early stages of the inflammatory response largely determine the predominantly cellular or humoral nature of the immune response. Pro-inflammatory cytokines - IL-1, IL-6, IL-8. IL-12, tumor necrosis factor (TNF) alpha, interferons (IF) alpha and gamma are synthesized and act on immunocompetent cells in the early stages of inflammation. The interaction of microorganisms with macrophage receptors leads to the induction of the synthesis and secretion of pro-inflammatory cytokines that ensure the development of an early inflammatory response. The main mediator of inflammation is IL-1. Cells respond with the production of IL-1 to the action of toxins and other components of microorganisms, activated components of the complement system, and other inflammatory mediators. Fever, neutrophilia, complement activation, synthesis of proteins of the acute phase of inflammation, IL-2, clonal proliferation of antigen-specific T cells are associated with an increase in the level of IL-1. The pro-inflammatory effects of IL-1 are synergistic with other cytokines, primarily TNF alpha and IL-6. The main producers of TNF alpha are monocytes and tissue macrophages. In the early period of inflammation, TNF alpha activates the endothelium, promotes the adhesion of leukocytes to the epithelium, their migration to the focus of inflammation, induces the production of other pro-inflammatory cytokines.	

		Anti-inflammatory cytokines (IL-4, IL-10, IL-13, TNF beta) constitute an alternative group to pro-inflammatory cytokines that limits the development of inflammation. Of significant importance is IL-4, the level of which is one of the criteria for assessing the Th2 response. IL-4, a factor in the activation of B-lymphocytes, is a growth factor for mast cells, T cells. IL-4 is synthesized and secreted by Th2 cells. According to the nature of the biological action and structural organization, several groups of cytokines are distinguished. Hematopoietics are cell growth factors. These include interleukins (IL), which are produced by activated T- and B-lymphocytes, macrophages, thymus stroma cells. The functional activity of these mediators is multidirectional. Interleukins (IL-2-IL-7, IL-9, IL-11, IL-11, IL-13, IL-15) provide growth stimulation, differentiation and activation of T-, B-lymphocytes, NK-cells, macrophages, granulocytes and monocytes, increased activity of mast cells, etc. The same group of hematopoietins includes colony-stimulating factors (CSF), which control the maturation, proliferation and activation of immune system cells (granulocytes, monocytes, macrophages). Interferons (IFN) take a versatile part in the regulation of the immune response, have antiviral activity. Tumor necrosis factors (TNF-α and TNF-β) are so named because they are able to lyse some tumors. Stimulate the processes of adhesion, antibody formation and activity of mononuclear cells. Secreted by activated macrophages. Chemokines attract leukocytes, monocytes and lymphocytes from	

		the blood to the focus of inflammation. Chemokines include IL-8, macrophaginizing factor (MYTH), etc. Cytokines are secreted by various cells (lymphocytes, macrophages, etc.) in the process of intercellular interaction in response to antigenic irritation (infectious agent) and normally direct the immune response along the most effective pathway. According to the profile of action, cytokines can be divided into pro-inflammatory and anti-inflammatory; according to the predominant orientation of the immune response - to Th1 (T-helper l - aimed at the formation of a cell-mediated immune response) and Th2 (mainly humoral). The balance of Thl / Th2 cytokines in the early stages of the inflammatory reaction largely determines the predominantly cellular or humoral nature of the immune response. Pro-inflammatory cytokines - IL-1, IL-6, IL-8. IL-12, tumor necrosis factor (TNF) alpha, interferons (IFN) alpha and gamma are synthesized and act on immunocompetent cells in the early stages of inflammation. The interaction of microorganisms with macrophage receptors leads to the induction of the synthesis and secretion of pro-inflammatory cytokines that ensure the development of an early inflammatory response. Anti-inflammatory cytokines (IL-4, IL-10, IL-13, TNF beta) constitute an alternative group to pro-inflammatory cytokines that limits the development of inflammation. Of significant importance is IL-4, the level of which is one of the criteria for assessing the Th2-response. IL-4 - the factor of activation of B-lymphocytes, is a growth factor for mast cells, T-cells. IL-4 is synthesized and secreted by Th2 cells. Th2-cytokines (IL-4, IL-	

		5, IL-6, IL-10, IL-13) enhance the antibody immune response and provide humoral immunity mainly against toxins and extracellular microorganisms. The immune response is a chain of successive complex cooperative processes that occur in the immune system in response to the action of an antigen in the body. There are: a primary immune response (occurs at the first meeting with the antigen); secondary immune response (occurs when re-encountering the antigen). Any immune response consists of two phases: inductive, representation and recognition of the antigen; there is a complex cooperation of cells with subsequent proliferation and differentiation; productive; the products of the immune response are detected. The following forms of immune response are known: - humoral immunity, based on the production of immunoglobulins; - cellular immunity, which is based on the production of effector T-lymphocytes; - immunological memory; - immunological tolerance; - immunological hyperreactivity (RWGT, WGNT); - Idiotip-anti-idiotypic relationship. The immune response is characterized by: specificity (reactivity is directed only at a certain agent, which is called an antigen); potentiation (the ability to produce an enhanced response with a constant intake of the same antigen into the body); immunological memory (the ability to recognize and produce an enhanced response against the same antigen when it is re-entered the body, even if the first and subsequent hits occur at long intervals). The humoral immune response is carried out by the	

		production of antibodies (immunoglobulins - Ig) to a foreign antigen (from the Latin. humor – liquid). They circulate in body fluids and provide neutralization of the antigen. On the surface of B-lymphocytes is the immunoglobulin receptor BcR (sIg - superficial Ig). It is he who recognizes, captures and carries the antigen inside the cell. Intracellular cleavage of the antigen occurs to form peptides. They, in combination with molecules of class II MHC, are carried to the surface of the B cell, providing processing of the antigen and presenting it in immunogenic form. The development of further events depends on the nature of the antigen. Thymus depending-antigens (TD) need the help of T-helper lymphocytes to produce antibodies. The immune response to thymus-independent antigens (LPS, bacterial polysaccharides, high-polymer proteins, etc.) is carried out without the participation of CD4 T helper cells. Only B cells with an antigen-recognizing immunoglobulin receptor are involved in this process. At the same time, the immune response develops rapidly, usually in the early stages of infection, but is less perfect. Without the participation of T helper cells, antibodies of only one isotype (IgM) are produced. The affinity (binding force) of these antibodies is low, and no memory cells are formed. The process of antibody formation occurs in the lymphoid tissue.	
5.	**Antibodies. Classes of immunoglobulins.**	Humoral immunity is characterized by the production of specific antibodies (immunoglobulins). Antibodies are specific proteins of gamma globulin nature that are formed in the body in response to antigenic stimulation	ID-1 GPC-5

		and are able to specifically interact with the antigen (in vivo, in vitro). In accordance with the international classification, a set of whey proteins with antibody properties is called immunoglobulins (Ig). Ig are divided according to localization into three groups: - serum Ig (in the blood); - secretory Ig (in secretions - the contents of the gastrointestinal tract, tear secretion, saliva, especially in breast milk) provide local immunity (immunity of mucous membranes); - superficial Ig (on the surface of immunocompetent cells, especially B-lymphocytes). Ig are characterized by a common type of structure. The structural unit of antibodies is a monomer consisting of two light (L) and two heavy (H) chains connected by disulfide bridges. Monomers are IgG, IgA (serum), IgD and IgE. Polymeric Ig has an additional jay-polypeptide chain that unites (polymerizes) individual subunits (as part of the IgM pentamer, the secretory IgA di- and trimer). According to the specificity and ability to bind the antigen in the Ig molecule, 3 fragments are distinguished: Each antibody molecule has two identical antigen-binding fragments Fab (fragment antigen binding), which determine antibody specificity, and one Fc (fragment constant) fragment that does not bind the antigen, but has effector biological functions. It interacts with "its" receptor in the membrane of different types of cells (macrophage, fat cell, neutrophil). The terminal regions of the light and heavy chains of the immunoglobulin molecule are variable in composition (amino acid sequences) and are designated as variable V_L and V_H regions. In their composition, hypervariable regions (3 in L- and 4 in H-chains) are	

		distinguished, which determine the structure of the active site of antibodies (antigen-binding center or paratope). Varieties of the sequence of amino acids in these hypervariable regions determine the specificity of the antibody. It is with the antigen-binding center that the antigenic determinant (epitope) of the antigen interacts. The antigen binding center of antibodies is complementary to the epitope of the antigen on the principle of "key-lock" and is formed by hypervariable regions of L- and H-chains. The antibody binds to the antigen (the key will get into the lock) only if the determinant group of the antigen is completely seated in the slit of the active site of the antibodies. Light and heavy chains consist of separate blocks – domains. In light (L) chains - two domains - one variable (V) and one constant (C), in heavy (H) chains - one V and 3 or 4 (depending on class Ig) C domain. There are light chains of two types - kappa and lambda, they are found in different proportions in the composition of different (all) classes of immunoglobulins. Antigenicity of antibodies. Immunoglobulin, like any protein, has antigenicity and pronounced immunogenicity. In the Ig molecule , 4 types of antigenic determinants are distinguished: species, isotypic, allotypic and idiotypic. Species antigenic determinants are characteristic of Ig of all individuals of a given species (for example, rabbit, dog, human). They are determined by the structure of the light and heavy chain, by these determinants it is possible to identify the species affiliation of AT. Isotypic antigenic determinants are group. They are localized in the heavy chain and	

		serve to differentiate the Ig family into 5 isotypes (classes) and many subclasses. Allotypic antigenic determinants are individual, i.e. inherent in a particular organism. They are located in light and heavy polypeptide chains. Allow you to distinguish individuals within the same species. Idiotipic antigenic determinants reflect the structural features of the antigen-binding center of the Ig molecule itself. They are formed by the V-domains of the light and heavy chain of the Ig molecule. The discovery of idiotypic antigenic determinants served as the basis for the creation of the theory of "idiotip-antiidiotypic" regulation of antibody biosynthesis. Specificity - the ability to interact with a certain (own) antigen (correspondence of the epitope of the antigen and the active site of antibodies). 1. Valence is the number of active sites capable of reacting with the antigen (this is due to the molecular organization - mono- or polymer). Immunoglobulins can be divalent (IgG) or polyvalent (IgM pentamer has 10 active sites). Two- or more valence antibodies are called complete antibodies. Incomplete antibodies have only one active site involved in interaction with the antigen (blocking effect on immunological reactions, for example, on agglutination tests). They are detected in the Coombs anti-globulin test, a complement binding inhibition reaction. 2. Affinity - (degree of affinity) - this is the binding strength between one antigenic epitope and one active center of the antibody, depends on their spatial correspondence.	

		3. The avidity of the antigen-antibody bond is an integral characteristic of the binding strength of the whole antigen molecule (all its epitopes) to all the active antigen-binding centers of the whole antibody molecule. Since antigens are often polyvalent, the bond between individual antigen molecules is carried out using several antibodies The binding of the antigen to the antibody is based on close contact, which is provided by van der Waals forces (through a cloud of electrons), hydrogen bonds, electrostatic attraction or hydrophobic bonds. - Heterogeneity - due to the antigenic properties of antibodies, the presence of three types of antigenic determinants: isotypic, allotypic and idiotipic - reflecting the individual characteristics of immunoglobulin, determined by the characteristics of antibody paratopes. Even when antibodies to a particular antigen belong to the same class, subclass and even allotype, they are characterized by specific differences from each other (idiotip). It depends on the structural features of hypervariable antigens. sections of the H- and L-chains are many different variants of their amino acid sequences.	
6	**Serological diagnosis of infectious diseases.**	In infectious diseases, the pathogen and its products (antigens, toxins, enzymes) are present in the internal environment of the body. The body's response to the presence of such foreign agents is expressed in the formation of antibodies or immune lymphocytes. For this purpose, immunochemical methods, which are also called serological (from the Latin serum - serum and logos - teaching), are widely used to detect AT or AG microorganisms in biological native materials obtained from sick or healthy people during	ID-2 GPC-5

		diagnostic and immunological studies. Microorganisms. These methods, depending on the nature and state of the antigen, can be combined into several groups: - direct methods of interaction and visual determination of the results of the Ag-AT reaction: agglutination, precipitation, lysis and complement binding reactions; - methods of passive agglutination using antigen or antibody carriers (reactions with witnesses). These include passive hemagglutination, latex agglutination, coagglutination, etc.; - reactions based on the use of various labels for one of the participants in the antigen-antibody interaction (enzyme, fluorescent, radioisotope, etc.). Depending on the label used, these tests are called enzyme-linked immunosorbent assay (ELISA), immunofluorescence response (RIF), radioimmunological test (RIT), etc. Specificity is characterized by the ability of hypertension to react only with homologous AT, sensitivity - the minimum amount of antigens (or antibodies) that can be detected using this reaction. Detection in the patient's blood serum of antibodies against the antigens of the pathogen allows you to diagnose the disease. When isolating a microbe from a patient, the pathogen is identified by studying its antigenic properties (identification of antigens) using immune diagnostic serums, that is, serums of blood of hyperimmunized animals containing specific antibodies. This is the so-called serological identification of microorganisms. Serological studies are also used to identify various biologically active substances, blood groups, tissue and	

		tumor antigens, immune complexes, cell receptors, etc. The direct in vitro reaction between Ag and AT consists of a specific and nonspecific phase. In the specific phase, there is a rapid specific complementary binding of the active site of the antibody to the determinant of the antigen to form IR. Enzyme-linked immunosorbent assay (ELISA) is an immunological reaction of a specific interaction between an antigen and an antibody, in which enzyme molecules (horseradish peroxidase, alkaline phosphatase, etc.) are used as an indicator. This test is based on the ability of the marker enzyme to break down the substrate - orthophenylenediamine for horseradish peroxidase or paranitrophenyl phosphate for alkaline phosphatase and cause a change in the color of the reactive medium. These enzymes have a unique property. These enzymes have a unique property. simultaneously modify a large number of substrate molecules, which leads to an increase in the sensitivity of the immunological reaction. The substrate/chromogen is added to the mixture after the antigen is combined with the enzyme-labeled immune serum. The substrate is split by the enzyme, and the color of the reaction product changes - the intensity of the color is directly proportional to the number of bound antigen and antibody molecules. Antimicrobial or antispecies antibodies can be marked with a marker enzyme, which involves the use of different methods of analysis: solid-phase ELISA, ELISA sandwich method, etc. The components of the immune complex are detected using a special printer - a multiscan reader, etc.	

		Solid-phase ELISA is the most common variant of the immunological test, when one of the components of the immune reaction (antigen or antibodies) is sorbed on a solid carrier, for example, in the wells of a polystyrene tablet. A solid-phase carrier can be sensitized not only by an antigen, but also by antibodies. Then the desired antigen is introduced into the wells with sorbed antibodies, an immune serum against the antigen is added, labeled with an enzyme, and then a substrate for the enzyme. A competitive variant of ELISA: The sought-after antigen and the enzyme-labeled antigen compete with each other to bind to a limited number of immune serum antibodies. Another test is the sought-after antibodies and labeled antibodies compete with each other for antigens. ELISA is used for the diagnosis of viral, bacterial and parasitic diseases, in particular for the diagnosis of HIV infections, hepatitis B, etc., as well as the determination of hormones, enzymes, drugs and other biologically active substances contained in the test material in minor concentrations - 10 10-10^{12} g / l.	
7.	**Immunological tolerance.**	Immunological tolerance (from Latin. tolerantia is a state of areactivity of the immune system, the specific "non-response" of the body only to certain antigens (pre-injected). At the same time, the ability to respond to any other antigens is preserved. Therefore, tolerance is specific to the antigen that caused it. Tolerance can be complete (no immune response) or partial (a significant decrease in response). Immunological tolerance is a special form of immune response characterized by the prohibition imposed by T and B suppressors on	ID-2 GPC-5

		the formation of effector cells against a given, including its own, antigen. There are two variants of manifestation of this phenomenon: natural tolerance, when the state of areactivity is formed to "its own", that is, to the antigens of its own tissues; induced tolerance to the "foreign" antigen - foreign cells, proteins, polysaccharides, haptens, etc. As an immunological phenomenon, tolerance was experimentally substantiated by the English researcher Medovar (1953) and the Czech scientist Hašek in 1963. Their experiments confirmed the hypothesis of the Australian immunologist Burnett that in the embryonic period the ability not to respond to "their" antigens is formed. Thanks to this phenomenon, the immune system can differentiate between "its own" and "foreign" and resist immune self-destruction. Acquired immunological tolerance is the absence of a specific immune reaction to a foreign antigen. Induced (acquired) immunological tolerance can occur at any period of life when the immune system (in particular, macrophages, T- and B-lymphocytes) come into contact with foreign Hypertension. However, the phenomenon of immunological tolerance is most easily reproduced during embryonic development. The immune system recognizes as "its" antigen, which was in contact with it during the embryonic period. Antigens that induce immunological tolerance are called tolerogens. Maintaining tolerance that has arisen in the embryonic or in any other period requires the presence of a tolerogen in the body. For example, the state of tolerance	

		to foreign red blood cells induced in the embryonic period continues as long as this Ah is present in the body. In the formation of induced immunological tolerance, central mechanisms associated with the direct effect on immunocompetent cells are involved: • increased activity of suppressor T and B cells, insufficiency of countersuppressors, in which the inhibition of the clone of peripheral T and B lymphocytes, NK cells is carried out by suppressor lymphocytes (CD8 T cells) with the help of cytokines. The role of inducers of suppressor cells can be played by an antigen introduced into the body in a small dose (low-dose tolerance); • blockade of effector cells; • antigen elimination of immunocompetent cells in the thymus and bone marrow (T and B cellIWespectively); • defectiveness of Ag's presentation; imbalance of the processes of proliferation and differentiation, cooperation of cells in the immune response; • clonal-deficient mechanism, characterized by the destruction of a clone of B-lymphocyte progenitor cells in the presence of an excess of antigen-tolerogen. The introduction of foreign Ag in the embryonic period also leads to clonal elimination of T cells. Peripheral mechanisms are associated with overload (depletion) of the immune system with antigen, passive administration of high-affinity antibodies, the action of anti-idiotypic antibodies, blockade of receptors by antigen, antigen-antibody complex. In the body of mammals there are organs and tissues to which there is no natural tolerance (brain,	

		eyes, testes, thyroid gland, adrenal glands, etc.). This is explained by the fact that during embryonic development, they did not have contact with lymphoid organs and cells. There is no contact of these organs with immunocompetent cells in postnatal ontogenesis. Therefore, they are called "barrier". When these organs are damaged, a normal immune response can develop as a protective reaction against the antigens of these tissues, called immune autoaggression.	
8.	**Clinical immunology. Allergic reactions**	In some cases, the introduction of an antigen into the body can induce an abnormal hyperergic reaction, which bears the features of a pathological process and is the direct opposite of immunological tolerance. This unusual form of response, which is based on natural physiological mechanisms, is called an allergy (from the Greek. alios is different and ergon is action). The study of allergies is an independent science - allergology. Accordingly, antigens that cause allergic reactions are called allergens. Hypersensitivity is called excessive or inadequate manifestation of reactions of acquired immunity. The basis of hypersensitivity is a normally useful immune response for the body, but in this case acting inadequately, often with the development of inflammation and tissue damage. Hypersensitivity reactions can be provoked by many antigens, and their causes are different in different people. Hypersensitivity does not manifest itself at the first, but, as a rule, only during subsequent contacts with the antigen. So, andthe allergy is the body's immune reaction, accompanied by damage to its own tissues. Allergic diseases are a group of diseases, the development	ID-2 GPC-5

		of which is based on damage caused by an immune reaction to exogenous allergens. Autoallergic diseases (or autoimmune) are a group of diseases whose development is based on damage caused by an immune reaction to antigens of one's own tissues (endoantigens). The term "allergy", meaning the altered reactivity of the host organism during its repeated encounters with the "agent", was first proposed in 1906 by von Pirke (Piruet) (without dividing the immunological reactions developing in this process by type). The term allergy has become synonymous for type 1 hypersensitivity only in recent years. The period between the primary ingestion of the allergen into the body and the secondary (after which an allergic reaction occurs) is called the period of sensitization. The period of sensitization can last from several days to several weeks, and even several decades. Sensitization can be induced by a very small, subimmunizing dose of antigen (for example, by injecting a guinea pig with 0.000001 ml of horse serum), which is called sensitizing. Repeated administration of the same antigen after a certain period of time causes an allergic reaction. The dose of antigen that causes the actual allergic reaction is called resolving. In the development of an allergic reaction, three stages are distinguished: - During the immunological stage , antigen-sensitive cells, specific antibodies and immune complexes are formed in response to the allergen. - The pathochemical stage is characterized by the formation of inflammatory mediators and	

		biologically active amines, which play a major role in the mechanism of allergic reactions. The stimulus for their formation is the connection of the allergen with antibodies or sensitized lymphocytes at the end of the immunological stage. - During the pathophysiological stage, the clinical picture of an allergic reaction appears. As a rule, the clinical manifestations of allergies are polymorphic. The first classification of allergies was proposed by R. Cook in 1947 , it was based on the time of development of an allergic reaction. Hypersensitivity of the immediate (GNT) and delayed (HRT) type were distinguished. A comparison of the properties of GNT and HRT is presented in the table: Properties of GNT and HRT (according to Cook, 1947) The study of the molecular mechanisms of allergies led to the creation of a new classification by Jell and Coombs (Coombs, Gell) in 1968. In accordance with it, four main types of allergies are distinguished: anaphylactic (type I), cytotoxic (type II), immunocomplex (type III) and cell-mediated (IV type). The first three types belong to GNT, the fourth to HRT. The reactions of the first three types are mediated by antibodies; the reactions of the fourth are mainly T cells and macrophages. In practice, they do not necessarily occur separately, they can be combined.	
9.	**Immunodeficiencies. Immune status.**	Immunodeficiency states (IDS) are called violations of the immune status and the ability to normal immune response to various antigens. These disorders are caused by defects in one or more parts of the immune system. The classification of immunodeficiency states can be based on different principles.	ID-2 GPC-5

		I. First of all, by origin, they are divided into primary (congenital) IDS and secondary IDS (acquired). - Primary are often associated with defects in genes that control the work of certain parts of the immune system. Genetically determined immunodeficiency states are detected mainly in children of the first year of life, who rarely live up to a year without active treatment with the replacement of identified defects. - Secondary (acquired) immunodeficiency states arise as a result of exposure to environmental factors on the cells of the immune system - in connection with infections, invasions, tumors, aging, burns, injurieIWadiation, the action of pharmacological agents, etc. II. Another principle of classification of immunodeficiencies is associated with the level of defect of the immune system, its defective link. Depending on the level of the defect, the following are distinguished: - immunodeficiencies caused by a predominant lesion of the B-link. Predominant defects of the B-system of immunity are detected as syndromes of hypogammaglobulinemia or agammaglobulinemia; - immunodeficiencies caused by a predominant lesion of the T-link (for example, thymus aplasia syndrome); - combined immunodeficiencies. The most severe are the combined defects of the T- and B-systems of immunity. A decrease in the level of immunoglobulins in the blood serum can affect either all classes, or selectively - one or two classes. Often there is a deficiency of secretory sIgA, which is associated with gross violations of the local	

		protection of the mucous membranes. It should be borne in mind that the same syndrome, for example, hypogammaglobulinemia, may be a consequence of a defect in different parts of the immune system. In one case, the cause may be a defect in B-lymphocytes, in others - a defect in the antigen-presenting function of macrophages, or a defect in T-helper cells. Iii. The third principle of classification of immunodeficiency states is based on the analysis of specific causes of their occurrence. The most commonly distinguished immunodeficiencies due to: - disorders of the humoral link of immunity (hypo- and agammaglobulinemia, etc.; - violations of the functions of the thymus and cellular immunity; - disorders in the phagocytosis system; - defects in the complement system; - violations of the main histocompatibility system; - violations of the production of interleukins, etc .; - severe combined disorders. Common manifestations of IDS include: - infectious syndrome (purulent-septic processes are associated with disorders of predominantly humoral immunity, opportunistic viral, fungal and protozoal diseases - with defects in cellular immunity); - gastrointestinal disorders (malabsorption, IgA deficiency, infections of the gastrointestinal tract); - tumors of the immune system; - allergic and autoimmune syndromes (atopy, autoimmune hemolytic anemia); - frequent combination with malformations (with congenital immunodeficiencies); - hematological changes (decrease in the number of lymphocytes and	

		neutrophils, eosinophilia, anemia, thrombocytopenia). Immune status is the state of the immune system in this patient at the moment of the study, which is assessed using a set of laboratory indicators that characterize the number and functional activity of immune system cells, as well as factors of nonspecific resistance of the body (Drannik G.N.). Immune status determines the effectiveness and consistency of the work of all systems and links of immunity - macrophages, complement, interferons, T and B lymphocytes, the main histocompatibility system. To make a diagnosis of an immunopathological condition, an immunological history is collected and immunological tests are performed. In vivo tests (skin tests), X-ray examination of lymphoid organs (thymus) can also be carried out. Based on WHO data and many years of experience in studying the immune status of healthy and sick people, R. V. Petrov created a two-stage approach to assessing the immune status. I. After identifying clinical signs of violations of a particular link of the immune system, their quantitative characteristics are investigated, the so-called indicative tests of the first level to identify "gross" defects in phagocytosis, cellular and humoral immunity: - determination of the absolute and relative content of lymphocytes in peripheral blood; - determination of the number of T- and B-lymphocytes; - determination of the level of immunoglobulins of the main classes (IgG, M, A); - determination of phagocytic activity of leukocytes;	

		- determination of complement titer (optional). II. Taking into account the analysis of the results of level 1 tests, further tactics of immunological research are determined. In the presence of significant changes in the immunogram, it is necessary to proceed to more complex, so-called analytical tests of the second level, which allow you to establish the severity of the immunological defect. These include almost all methods by which it is possible to assess the functional activity of phagocytes, auxiliary cells, NK, T and B cells.	
10.	**Immunoprophylaxis. Immunotherapy.**	Immunoprophylaxis and immunotherapy are branches of immunology that study and develop methods and methods for the specific prevention, treatment and diagnosis of infectious and non-infectious diseases with the help of immunobiological preparations that affect the function of the immune system, or whose action is based on immunological principles. Immunotherapy is a method of treatment in which the immune system is affected: suppression of the immune response (immunosuppression), stimulation of the response (immunostimulation), restoration of immunodeficiencies (immunocorrection). In the applied, narrower sense, immunotherapy uses specific methods of serotherapy (the use of immune serums, immunoglobulins), vaccine therapy (therapeutic vaccines), immunocorrection (desensitization, etc.). Immunoprophylaxis is a way to prevent infectious diseases by creating artificial specific immunity. There are vaccine prophylaxis (the creation of active immunity due to vaccines, antigens) and seroprophylaxis (passive	ID-2 GPC-5

		immunity by introducing specific antibodies into the body - immunoglobulins). Vaccination. Mankind owes vaccination to E. Jenner, who in 1796 showed that the vaccination of cowpox - vaccination (vaccinum - from the Latin cow) is effective for the prevention of smallpox. Since then, the drugs used to create active immunity are called vaccines. Immunoprophylaxis and immunotherapy are used in cases where it is necessary: a) to form, create specific immunity or activate the activity of the immune system; b) suppress the activity of individual parts of the immune system; c) normalize the work of the immune system, if there are deviations of its function in one direction or another. Immunoprophylaxis and immunotherapy are widely used in various fields of medicine, primarily in the prevention and treatment of infectious diseases, allergies, immunopathological conditions, in oncology, transplantology, in primary and secondary immunodeficiencies and other diseases. Immunobiological preparations have a complex composition, differ in nature, methods of obtaining and using, intended purpose. However, as mentioned above, what they have in common is that they act either on the immune system or through the immune system, or their mechanism of action is based on immunological principles. The active principle in the UPS is either antigens obtained in one way or another, or antibodies, or microbial cells and their derivatives, or biologically active substances such as immunocytokines, immunocompetent cells and other	

		immunoreagents. In addition to the active principle, UPSs can, depending on their nature and nature, include stabilizers, adjuvants, preservatives and other substances that improve the quality of the drug (for example, vitamins, adaptogens). The main role in the specific prevention of infectious diseases has vaccine prophylaxis. Vaccines are biologics prepared from microbes or their antigens, which are used to prevent infectious diseases. The body responds to the introduction of the vaccine by forming artificial active immunity due to the production of antibodies or primed lymphocytes. There are a number of types of vaccines - live, killed, component and subunit, recombinant, synthetic oligopeptide, anti-idiotypic, etc. 1. Killed (inactivated) vaccines are vaccine preparations that do not contain live microorganisms. Vaccines can contain whole microbes (corpuscles) - vaccines against plague, influenza, Salk polio vaccine, as well as individual components (polysaccharide pneumococcal vaccine) or immunologically active fractions (hepatitis B virus vaccine). 2. Live attenuated (attenuated) vaccines. These vaccines have some advantages over the killed. They completely preserve the antigenic set of the microorganism and provide a longer state of specific immunity. Live vaccines are used to prevent poliomyelitis, tularemia, brucellosis, measles, yellow fever, mumps. 3. Component (subunit) vaccines consist of the main (major) antigenic components that can provide protective immunity. They can be:	

		- components of cell structures (cell wall antigens, H- and Vi-antigenIWibosomal antigens); - toxoids - preparations containing chemically modified exotoxins, devoid of toxic properties, but retaining high antigenicity and immuno-generosity. These drugs provide the production of antitoxic immunity (antitoxic antibodies - antitoxins). The most widely used are diphtheria and tetanus toxoids. DTP is an associated pertussis-diphtheria-tetanus vaccine. - subunit vaccines. The hepatitis B virus vaccine is prepared from surface proteins (subunits) of viral particles (HBs antigen). Currently, this vaccine is obtained on a recombinant basis - using yeast cells with a plasmid encoding the HBs antigen. 4.Recombinant vaccines. With the help of genetic engineering methods, the genes that control the synthesis of the most significant immunogenic determinants are embedded in self-replicating genetic structures (plasmids, viruses). If the carrier (vector) is the smallpox vaccine virus, then this vaccine will induce immunity in the body not only against smallpox, but also against the pathogen whose gene was embedded in its genome (if the HBs antigen gene is against the hepatitis B virus). If the vector is a plasmid, then during the reproduction of a re-combinant clone of the microorganism (yeast, for example), the necessary antigen is produced, which is used in the future for the production of vaccines. 5. Synthetic oligopeptide vaccines. The principles of their construction include the synthesis of peptide sequences that form epitopes	

		recognized by neutralizing antibodies. 6. Cassette or exposure vaccines. A protein structure is used as a carrier, on the surface of which the corresponding certain antigenic determinants introduced by chemical or genetically engineered means are exposed (arranged). 7. Liposomal vaccines. They are complexes consisting of antigens and lipophilic carriers (for example, phospholipids). Immunogenic liposomes more effectively stimulate the production of antibodies, the proliferation of T-lymphocytes and the secretion of IL-2 by them. 8. Anti-idiotypic vaccines. Anti-idiotypic antibodies contain an "internal" specific portrait of the antigenic determinant. Monoclonal anti-idiotypic antibodies containing an "internal image" of the protective antigen are obtained. Currently, 7 toxoids, about 20 antiviral and more than 20 antibacterial vaccines are produced in our country. Some of them are associated - i.e. containing antigens of different pathogens, or one, but in different versions (corpuscular and chemical). • Depending on the number of antigens, mono-, di-, tri-, tetra- or polyvaccines are prepared. Combined (from several different bacteria) and associated vaccines consisting of killed bacteria and toxoids (for example, chemical sorbed typhoid-paratyphoid-tetanus vaccine) are used. Toxoids (toxoids) (an - denial, toxo - poison) are drugs that are obtained from bacterial exotoxins. They are completely devoid of toxic properties, but retain immunogenicity. When injected into the body, they induce the production of immunoglobulins - antitoxins. The method of obtaining toxoid was proposed in 1923 by the French scientist Ramon.	

		To obtain toxoid, a 0.3-0.4% formalin solution is added to the filtrate of the nutrient broth, in which exotoxin-producing bacteria were grown, and 3-4 weeks in a thermostat at 37-40 ° C. Toxoids are prepared in the form of drugs adsorbed on adjuvants. They are often part of associated vaccines. Toxoids are used to prevent diphtheria, tetanus, staphylococcal infection, etc.	

5.2. Sections of discipline and labor intensity by types of educational work

Section No.	Name of the discipline section	Types of educational work, hour.				Altogether hour.
		classroom			extracurricular	
		L	PE	LC	IWS	
1.	Immunity. Types of immunity. Innate immunity. Non-specific factors of innate immunity.	2	6	-	4	12
2.	Immune system. Immunocompetent cells.	2	4	-	4	10
3.	Antigens. Classification. Views. Properties.	2	8	-	4	14
4.	Endogenous immunoregulators. Humoral and cellular immune response.	2	4	-	4	10
5.	Antibodies. Classes of immunoglobulins.	2	2	-	4	8
6.	Serological diagnosis of infectious diseases.	1	8	-	2	11
7.	Immunological memory. Features of immunity in various infections. Immunological tolerance. Transplacental immunity, Protifloral immunity.	2	8	-	4	14
8.	Clinical immunology. Allergic reactions. Autoimmune reactions and diseases.	2	6	-	4	12
9.	Immunodeficiencies. Methods of studying the immune status.	2	4	-	4	10
10.	Immunoprophylaxis. Principles of immunotropic therapy.	1	4	-	2	7
	TOTAL:	**18**	**54**	**-**	**36**	**108**

5.3. Thematic plan of lectures

Section No.	Discipline section	Topics of lectures	Number of hours per semester VI
1.	**Immunity. Types of immunity. Innate immunity. Non-specific factors of innate immunity.**	L 1. Introduction to Immunology. Immunity. Types of immunity. Innate immunity. Modern ideas about the factors of cellular and humoral immunity.	2
2.	**Immune system. Immunocompetent cells.**	L.2. Immune system, structure, functions. Immunocompetent cells. Origin and differentiation of T and B lymphocytes. The concept of markers.	2
3.	**Antigens. Classification. Views. Properties.**	L.3. Antigens, properties. Microbial antigens. Antigens of microorganisms. Antigens of the main histocompatibility complex.	2
4.	**Endogenous immunoregulators. Humoral and cellular immune response.**	L.4. Humoral and cellular immune response. Antibodies, classes of immunoglobulins, their characteristics. Hormones and mediators of the immune system.	2
5.	**Antibodies. Classes of immunoglobulins.**	L.5. Applied immunology. Serological methods of research.	2
6.	**Serological diagnosis of infectious diseases.**		
7.	**Immunological memory. Immunological tolerance. Transplacental, antitumor immunity.**	L.6. Features of the immune response in various conditions. Immune response in bacterial, protozoal, fungal and viral infections. Immunological memory. Immunological tolerance. Transplantation and antitumor immunity.	2
8.	**Clinical immunology. Allergic reactions. Autoimmune reactions and diseases.**	L.7. Immunopathology. Immunological hypersensitivity (allergy). Autoimmune reactions and diseases.	2
9.	**Immunodeficiencies. Methods of studying the immune status.**	L.8. Immune status. Congenital and acquired immunodeficiencies. Methods of detection and correction.	2
10.	**Principles of immunotropic therapy. Immunoprophylaxis.**	L.9. Basics of immunoprophylaxis and immunotherapy. Immunomodulators.	2
TOTAL:			**18**

5.4. Thematic plan of practical exercises

No raz-dela	Partition Discipline	Topics of practical exercises	Forms of current control	Number of hours per semester VI
1.	Immunity. Types of immunity. Innate immunity. Non-specific factors of innate immunity.	PE.1 "Immunity. Types of immunity»	T	2
		PE.2 "Cellular factors of innate immunity. Phagocytosis»	S, NW	2
		PE.3 "Innate immunity. Factors of innate immunity»	S, NW	2
2.	Immune system. Immunocompetent cells.	PE.4 "Lymphoid system"	S, NW	2
		PE.5 "Immunocompetent cells"	S, NW	2
3.	Antigens. Classification. Views. Properties.	PE.6 "Antigens, classification, species, properties"	S, NW	2
		PE.7 "Antigens of microorganisms"	S, NW	2
		PE.8 "Antigens of the human body"	S, NW	2
		PE.9 **"Final lesson on topics 1-8»**	T, S, NW	2
4.	Endogenous immunoregulators. Humoral and cellular immune response.	PE.10 Endogenous immunoregulators. Hormones, cytokines, their role in immunity. Apoptosis.	S, NW	2
		PE.11 Humoral and cellular immune response.	S, NW	2
5.	Antibodies. Classes of immunoglobulins.	PE.12 Antibodies. Classes of immunoglobulins.	S, NW	2
6.	Serological diagnosis of infectious diseases.	PE.13 Classification of serological reactions. Agglutination reaction, its variants. PE.14 Precipitation reactions, variants. Lysis reactions, variants.	S, Pr, NW	4
		PE.15 Serological reactions with an antigen or antibody label (RIF, IPM, RIM).	S, Pr, NW	2
		PE.16 **Final lesson on topics 10-14.**	T, S, NW	2
7.	Immunological memory. Features of the immune response in various infections. Immunological tolerance. Transplacental immunity. Protivatumor immunity.	PE.17. Immunological memory: Differences between primary and secondary immune response. Features of the immune response in various infections caused by bacteria, viruses, fungi, protozoa	S, NW	8
		PE. 19. Immunological tolerance.		
		PE. 20. Transplacental immunity.		
		PE. 21. Antitumor immunity.		

8.	Clinical immunology. Allergic reactions. Autoimmune reactions and diseases.	PE. 22. Allergic reactions. Mechanisms of development of allergic reactions. Classification of allergic reactions according to Jell and Coombs.	S, NW	2
		PE. 2. 3 Infectious allergy. Allergic reactions type IV. Principles of diagnosis of allergic diseases. PE. 24. Autoimmune reactions and diseases. Autoantigens. Autoantibodies. Principles of diagnosis and therapy of autoimmune diseases.	S, NW	4
9.	Immunodeficiencies Methods for studying the immune status.	PE.25. Primary and secondary immunodeficiencies. Methods of diagnosis and correction of immunodeficiencies. Methods of studying the immune status.	S, NW S, NW	4
10.	Principles of immunotropic therapy. Immunoprophylaxis.	PE.26. Principles of immunotropic therapy. Immunoprophylaxis, immunotherapy.	S, NW	2
		PE.27 Final lesson on topics 16-23.	T, S, NW	2
TOTAL:				**54**

5.5. Educational and methodological support for independent work on the discipline

5.5.1. Independent work of the student by discipline

No p/n	Partition Discipline	Title of works	Work Capacity (hour)	Forms of control
1.	Immunity. Types of immunity. Innate immunity.	Filling in the main terms of the section in the workbook; study of educational and scientific literature Preparation for practical exercises - filling in the main terms of the section in the workbook; study of educational and scientific literature.	2	IW
		Preparation for practical exercises - filling in the main drawings and terms of the section Types of immunity in the workbook; study of educational and scientific literature. Work with electronic educational resources located in the electronic information system of DSMU	2	IW
2.	Immune system. Immunocompetent cells.	Preparation for practical exercises-filling in the workbook of the main drawings and terms of the section Immune System; abstract messages on immunocompetent cells;	4	IW

		Work with electronic educational resources located in the electronic information system of DSMU		
3.	Antigens. Classification. Views. Properties.	Preparation for practical exercises-filling in the workbook of the main drawings and terms of the section; abstract messages on the topics: "Antigens. Classification". Work with electronic educational resources located in the electronic information system of DSMU. **Preparation for testing and testing.**	4	IW
4. 5.	Endogenous immunoregulators. Humoral and cellular immune response. Antibodies. Classes of immunoglobulins	Preparation for practical exercises - filling in the main terms of the endogenous immunoregulators section in the workbook. Study of educational and scientific literature. Work with electronic educational resources located in the electronic information system of DSMU.	4 4	IW
6.	Serological diagnosis of infectious diseases.	Preparation for practical exercises - filling in the workbook diagrams of the main serological and immunological reactions used for the diagnosis of infectious diseases. Study of educational and scientific literature. Work with electronic educational resources located in the electronic information system of DSMU. **Preparation for testing and testing**	2	IW
7.	Immunological memory. Immunological tolerance.	Preparation for practical exercises - filling in the drawings and terms of the section "Immunological memory" in the workbook; study of educational and scientific literature; preparation of abstracts on the topics and "Immunological tolerance". Work with electronic educational resources located in the electronic information system of DSMU	4	IW
8.	Clinical immunology. Allergic reactions.	Preparation for practical exercises - filling in the main drawings and terms of the section "Clinical immunology. Allergic reactions"; study of educational and scientific literature. Work with electronic educational resources located in the electronic information system of DSMU	4	IW
9.	Immunodeficienc	Preparation for practical exercises - filling in the main drawings and terms of the	4	IW

	ies. Immune status.	section "Methods of studying the immune status. Immunodeficiencies"; study of educational and scientific literature. Work with electronic educational resources located in the electronic information system of DSMU.		
10.	Immunoprophylaxis. Immunotropic therapy.	Preparation for practical exercises - filling in the main drawings and terms of the section "Principles of immunotropic therapy" in the workbook; study of educational and scientific literature. Work with electronic educational resources located in the electronic information system of DSMU. **Preparation for testing and testing**	2	IW
	TOTAL:		**36**	
	Preparation for the test	Repetition and consolidation of the studied material (work with lecture material, educational literature); formulation of questions; pre-examination individual and group consultations with the teacher. Work with electronic educational resources located in the electronic information system of DSMU.	2	IW

5.5.2. Subjects of abstract works

№	Partition	Subject
1	1	Immunology as a science. The significance of the works of I.I. Mechnikov.
2	2,3	Factors of innate immunity.
3	4	Antigens of the human body.
4	4	Endogenous immunoregulators.
5	7	Transplantation immunity.
6	8	Antitumor immunity.
7	8	Allergic reactions. Anaphylactic shock..
8	10	Immunodeficiencies.
9	10	Autoimmune diseases.
10	10	Immunoprophylaxis and immunotherapy.

5.5.3. Methodical instructions for students on mastering the discipline

The first section of the work program of the discipline was developed as an independent document "Methodological recommendations for the student" in the form of an appendix to the workprogram of the discipline.

VI. ASSESSMENT TOOLS FOR ONGOING PERFORMANCE MONITORING AND INTERMEDIATE CERTIFICATION BASED ON THE RESULTS OF THE DISCIPLINE

6.1. Current monitoring of academic performance

6.1.1. List of competencies indicating the stages of their formation in the process of mastering the work program of the discipline

№ Section	Name of the discipline section (module)	Supervised competency code (or part of it)	Forms of control
1	2	3	4
1.	Immunity. Types of immunity. Innate immunity.	ID-1 GPC-5	S, T, NW
2.	Immune system. Immunocompetent cells.	ID-1 GPC-5	S, T, NW
3.	Antigens. Classification. Views. Properties.	ID-1 GPC-5	S, T, NW
4.	Endogenous immunoregulators. Humoral and cellular immune response.	ID-1 GPC-5	S, T, NW, R
5.	Antibodies. Classes of immunoglobulins.	ID-1 GPC-5	S, T, NW, R
6.	Serological diagnosis of infectious diseases.	ID-2 GPC-5	S, T, NW
7.	Immunological memory. Features of the immune response in various infections. Immunological tolerance. Transplantation immunity. Antitumor immunity.	ID--2 GPC-5	S, T, NW
8.	Clinical immunology. Allergic reactions.	ID-2 GPC-5	S, T, NW, R
9.	Immunodeficiencies. Methods of studying the immune status.	ID-2 GPC-5	S, T, NW
10.	Principles of immunotropic therapy. Immunoprophylaxis.	ID-2 GPC-5	S, T, NW, R

6.1.2. Examples of assessment tools for current and milestone control

SECURITY INTERVIEW

SECTION 1. **Immunity: Types of immunity. Cellular factors of innate immunity.**

Topic #1: Immunity. Types of immunity.

Codes of controlled competencies: ID-1 GPC-5

1. The modern concept of immunity.
2. Types of immunity.
3. Congenital (species) immunity.
4. Acquired immunity. Views.
5. The main differences between congenital and acquired types of immunity.
6. What factors are the non-specific protection of the body?
7. Which cells have phagocytic ability?
8. What are the stages of phagocytosis?
9. What happens at each stage of the phagocytic reaction?
10. What is incomplete phagocytosis? Completed?
11. What is a phagocytic number? Phagocytic index? How are they defined?
12. How is the phagocytosis completeness index determined?

Criteria for assessing the current monitoring of academic performance (security interview):

✓ "Excellent":

The student has deep knowledge of the educational material on the topic of the practical lesson, formulated a complete and correct answer to the questions of the topic of the lesson, in compliance with the logic of the presentation of the material, shows the assimilation of the relationship of the basic concepts used in the work, was able to answer all clarifying and additional questions. The student demonstrates knowledge of theoretical and practical material on the topic of the lesson.

✓ "Good":

The student showed knowledge of the educational material, mastered the basic literature, was able to answer almost completely all the additional and clarifying questions asked. The student demonstrates knowledge of theoretical and practical material on the topic of the lesson, allowing minor inaccuracies.

✓ "Satisfactory":

The student as a whole mastered the material of the practical lesson, answered not all clarifying and additional questions. The student finds it difficult to correctly assess the proposed task, gives an incomplete answer that requires leading questions from the teacher.

✓ "Unsatisfactory":

The student has significant gaps in the knowledge of the main educational material of the practical lesson, did not fully disclose the content of the questions, could not answer clarifying and additional questions. The student gives an incorrect assessment of the situation, incorrectly chooses the algorithm of actions. An unsatisfactory grade is given to a graduate who refuses to answer the questions of the topic of the practical lesson.

TESTING

SECTION 2. **Immune system: Immunocompetent cells.**

Topic I am No.4. Lymphoid system.

Codes of controlled competencies: ID-1 GPC-5

1. The central task of immunity:
A) ensuring the genetic integrity of the organism
B) provision of anti-infective protection
B) rejection of transplanted cells, tissues and organs
D) implementation of programmed cell death (apoptosis)
E) ensuring a state of tolerance to "one's own".

2.Acquired immunity is characterized by:
(A) Specificity
B) formation of antibodies
C) formation of immunological memory
D) activation of the endocrine system
E) erythropoiesis.

3. Phagocytes include:
A) Macrophages
B) neutrophils
C) Th-lymphocytes
D) NK-cells
E) B-lymphocytes.

4. Blood bactericidal factors include:
A) lysozyme
B) C-reactive protein
C) complement
D) Fibrinogen
E) beta-lysines

5. Lymphopoiesis is carried out by:
A) in the bone marrow
B) in the spleen
B) in the lymph nodes
D) in Peyer plaques of the intestine
E) All of the above is true.

6. The main functions of the specific immune response are:
A) formation of antibodies
B) accumulation of sensitized lymphocytes
B) pinocytosis
D) Phagocytosis
E) activation of the endocrine system

7. The cell-humoral theory of immunity is substantiated by:
A) R. Kochom
B) I. Mechnikov
B) L. Pasteur

D) P. Ehrlich
E. Bering.

8. Features of innate immunity:
A) is realized only by lymphoid cells
B) is realized only by myeloid cells
C) activated only when exposed to antigen
D) is activated regardless of the ingress of the antigen
E) forms cells of immunological memory.

9. T-oll-like receptors recognize:
A) virus antigens
B) groups of lipids of surface antigens of bacteria
C) immune complexes
D) carbohydrate groups of surface antigens of bacteria
E) superantigens.

10. The skin, as a peripheral part of the immune system, contains:
A) Dendritic cells
B) NK cells
B) B-lymphocytes
D) Kupffer cages
E) mast cells.

Criteria for assessing the current monitoring of academic performance (testing):

- ✓ "Excellent": 100-90%
- ✓ "Good": 89-70%
- ✓ "Satisfactory": 69-51%
- ✓ "Unsatisfactory": <50%

PRACTICAL SKILLS

SECTION 1. **Immunity: Types of immunity. Cellular factors of innate Immunity.**

Topic I 4. Innate Immunity: Factors of Innate Immunity

Immunity

Codes of controlled competencies: ID-1 GPC-5

1. Research methods in immunology, allergology
2. Determination of the index of bactericidal activity of the skin. The principle of the method. Diagnostic value of the method for determining the state of factors of nonspecific resistance of the skin and mucous membranes

Criteria for assessing the current monitoring of academic performance:

- ✓ "Unsatisfactory":

The student does not know a significant part of the program material, makes mistakes, uncertainly, with great difficulties performs practical tasks.

- ✓ "Satisfactory":

However, he has not mastered its details, admits inaccuracies, insufficiently correct wording, violates the consistency in the presentation of the program material; owns only a minimum of laboratory research.

- ✓ "Good":

The student firmly knows the program material, correctly and essentially presents it; does not allow significant inaccuracies when answering questions; correctly applies theoretical provisions in solving practical issues and tasks; has the necessary skills and techniques for their implementation.

- ✓ "Excellent":

The student has deeply and firmly mastered the program material: fully, consistently, competently, logically presents it. In answering, it closely links theory with practice; is well acquainted with the main literature, is guided in the choice of methods of laboratory diagnosis of infectious diseases to the extent necessary for the practical activities of the doctor, is able to apply knowledge within the framework of the answers presented; connects aspects of the subject with the tasks of practical health care.

ABSTRACT

SECTION 8. **Immunopathology.**

Codes of controlled competencies: ID-2 GPC-5

Topics of abstracts:

Allergic reactions. Anaphylactic shock.
Immunodeficiencies.
Autoimmune diseases.

Criteria for assessing current control (abstract):

- Novelty of the refereed text: max. – 20 points;
- Degree of disclosure of the essence of the problem: max. – 30 points;
- Validity of the choice of sources: max. – 20 points;
- Compliance with the requirements for registration: max. – 15 points;
- Literacy: max. – 15 points.

Evaluation of the essay:

The abstract is evaluated on a 100-point scale, the points are translated into academic performance assessments as follows (points are taken into account in the process of current assessment of the knowledge of the program material):

- ✓ 86 – 100 points – "excellent";
- ✓ 70 – 75 points – "good";
- ✓ 51 – 69 points – "satisfactory;
- ✓ less than 51 points – "unsatisfactory".

INTERVIEWS ON CONTROL QUESTIONS BY DISCIPLINE BLOCKS

SECTION 2. **Immune system: Immunocompetent cells.**

Topic I am No.4. Lymphoid system.

Codes of controlled competencies: ID-1 GPC-5

1. Central and peripheral organs of the lymphoid system.
2. The principle of organization of the immune system.
3. Hematopoietic red bone marrow. Functions.
4. Thymus. Functions.
5. Peripheral organs of the lymphoid system. Functions.
6. Which cells are called "immunocompetent"?
7. Characteristics and functions of T-lymphocytes.
8. How and where does T lymphocyte differentiation occur?
9. Characteristics and functions of B-lymphocytes.
10. How and where does the differentiation of B-lymphocytes occur?
11. What are the similarities and differences in the functions of T and B lymphocytes?
12. What is the role of antigen-presenting cells?
13. Describe the NK cells.
14. Describe gamma-delta lymphocytes, their features and functions.

Criteria for assessing the current monitoring of progress (interview):

"Unsatisfactory":

✓ Knowledge: the student is not able to independently identify the main provisions in the studied material of the discipline. Does not know or understand much or most of the program material within the questions posed.

✓ Skills: The student does not know how to apply incomplete knowledge to solving specific questions and situational problems according to the model.

✓ Skills: The student does not have practical skills.

"Satisfactory":

✓ Knowledge: the student has mastered the main content of the material of the discipline, but has gaps in the assimilation of the material that do not prevent the further assimilation of the educational material in the discipline "Immunology". Has unsystematized knowledge of the modules of the discipline**.** The material is presented fragmentarily, not sequentially.

✓ Skills: the student has difficulties in presenting the material on the modules of the discipline "Immunology". The student inconsistently and systematically knows how to use incomplete knowledge of the material. The student finds it difficult to apply the knowledge necessary to solve problems of various situational types, when explaining specific concepts in the sections "Immunology"

✓ Skills: the student has the basic skills, but makes mistakes and inaccuracies in the scientific terminology used and in the answers. The student is basically able to independently make the main points in the material studied.

"Good":

✓ Knowledge: The student is able to independently identify the main provisions in the studied material. Shows knowledge of all the studied program material. Gives a complete and correct answer based on the studied theoretical and practical materials; minor errors and shortcomings in the reproduction of the studied material, definitions of concepts gave incomplete, small inaccuracies when using scientific terms.

✓ Skills: The student is able to independently highlight the main provisions in the studied material; on the basis of facts and examples to generalize, draw conclusions, establish

intra-subject connections. The student is able to use the knowledge gained in practice in a modified situation, to observe the basic rules of the culture of oral speech, to use scientific terms.

✓ Skills: The student has the knowledge of all the studied program material, the material is presented consistently, makes minor mistakes and shortcomings in the reproduction of the studied material. The student does not have sufficient skill in working with reference literature, textbook, primary sources; correctly orients, but works slowly.

"Excellent":

✓ Knowledge: The student independently identifies the main provisions in the studied material and is able to give a brief description of the main ideas of the developed material of the discipline "Immunology". He knows the basic concepts in the sections of obstetrics and gynecology. Shows a deep knowledge and understanding of the entire volume of program material.

✓ Skills: The student is able to make a complete and correct answer on the basis of the material studied, highlight the main provisions, independently confirm the answer with various situational tasks, independently and reasonably make analysis, generalizations, conclusions. To establish interdisciplinary (on the basis of previously acquired knowledge) and intra-subject connections, creatively apply the knowledge gained to solve obstetric problems. Consistently, clearly, coherently, reasonably and accurately present the educational material; give an answer in a logical sequence using the accepted terminology; draw your own conclusions; formulate a precise definition and interpretation of the basic concepts and rules; when answering, do not repeat verbatim the text of the textbook; to present the material in literary language; correctly and thoroughly answer additional questions of the teacher. Independently and rationally use visual aidIWeference materials, a textbook, additional literature, primary sources.

✓ Skills: The student independently identifies the main provisions in the studied material and is able to give a brief description of the main ideas of the developed material. The student shows a deep and complete knowledge of the entire volume of the discipline being studied.

SITUATIONAL TASKS BY SECTIONS OF THE DISCIPLINE

SECTION 6. **Serological reactions.**

Codes of controlled competencies: ID-2 GPC-5

Task 1

A patient with a high fever was admitted to the clinic. Vidal's reaction is positive in the titer of 1:200 with O - typhoid diagnosis. Your conclusion.

Task 2

In a patient admitted to an infectious diseases clinic with suspected typhoid fever, Vidal's reaction is positive in the dilution of serum 1: 800 with O - diagnosticum and 1: 400 with H - diagnosticum. Do the results of the reaction confirm the alleged diagnosis?

Task 3

The agglutination reaction of the isolated culture of dysentery sticks with specific serums of groups A, B, C, D. A positive reaction was obtained with serum D. Give a conclusion.

Task 4

A patient with syphilis was admitted to the dermatovenerologic dispensary. How to laboratory confirm the diagnosis?

Task 5

From the laboratory of the dermatovenerologic dispensary, the results of the wasserman reaction of the patient I.S. were obtained.

RSC with cardiolipin antigen is positive.
with treponemal antigen - positive.
Explain what antigens #1 and 2 are.

Criteria for assessing the current control of academic performance (situational tasks):

✓ "Excellent":

The answer to the question of the problem is given correctly. The explanation of the course of its solution is detailed, consistent, competent, with theoretical justifications (including from the lecture course).

✓ "Good":

The answer to the question of the problem is given correctly. The explanation of the course of its solution is detailed, but not logical enough, with isolated errors in details, some difficulties in the theoretical justification (including from lecture material), in schematic images and demonstrations on obstetric phantoms, with isolated errors in the use of immunological terms; the answers to additional questions are correct, but not clear enough.

✓ "Satisfactory":

The answer to the question of the problem is given correctly. The explanation of the course of its solution is insufficiently complete, inconsistent, with errors, weak theoretical justification (including lecture material), with significant difficulties and errors in schematic images, demonstrations, in the use of immunological terms; the answers to additional questions are not clear enough, with errors in detail.

✓ "Unsatisfactory":

The answer to the question of the problem is given incorrectly. The explanation of the course of its solution is given incomplete, inconsistent, with gross errors, without theoretical justification (including lecture material); answers to additional questions are incorrect (missing).

TESTING BY DISCIPLINE SECTIONS

SECTION 4. **Endogenous immunoregulators.**
Codes of controlled competencies: ID-2 GPC-5

1. Activation of the complement system in the classical way is associated with:
A) with the production of interleukin-2
B) exposure to interferons
B) involving an antigen/antibody complex
D) activation of Toll-like receptors
E) All of the above is true.

2. Activation of the complement system along the lectin pathway is associated with the action:
A) Cytokines of NK-cells
B) NK cell perforins
B) Mast Cell Histamine
D) antibiotic peptides
E) All of the above is incorrect.

3.Dendritic cells are cells that:
A) are formed in the bone marrow

B) are formed in the thymus gland
B) perform antigen-presenting function
D) express histocompatibility antigens of class II
E) synthesize antibodies.

4.5.Mark the stages of phagocytosis:
A) Adhesion
B) hemolysis
B) agglutination
D) chemotaxis
E) endocytosis

25. Mucous membranes secrete:
A) lysozyme
B) Ig A
C) IgE
D) beta-lysine
E) complement.

6. Natural immunity of newborns is formed as a result of:
(A) Vaccination
B) administration of immune serums
C) transmission of antibodies from mother to fetus
D) antibiotic therapy
E) All of the above is true.

7. After the introduction of antitoxic therapeutic and prophylactic serum immunity is formed:
A) Active
B) passive
B) Artificial
D) antimicrobial
E) congenital.

8.Acquired active immunity occurs after the introduction into the body:
A) Attenuated vaccine
B) probiotics
B) toxoids
D) antitoxic serum
E) antibiotics.

9.In the implementation of the functions of adaptive immunity take part:
A) Immunological memory cells
B) Dendritic cells
B) NK cells
D) immunoglobulins
E) All of the above is true.

10.Possible ways to activate complement:
A) Anaerobic
B) Classic
(B) Alternative

D) lectin
E) lactose

11.Note the signs characteristic of the complement system:
A) refers to serum proteins
B) activated by a cascade of proteolysis reactions
C) is only present in humans
D) specific to the antigen
E) refers to interleukins.

12.The mechanism of complement activation by the classical path is related to:
A) involving an antigen-antibody complex
B) with the participation of the protein properdin
B) with the action of antibiotics
D) with recognition of mannose-binding lectin
E) involving Ig-E.

Criteria for assessing the current monitoring of academic performance (tests):

- ✓ "Excellent": 100-90%
- ✓ "Good": 89-70%
- ✓ "Satisfactory": 69-51%
- ✓ "Unsatisfactory": <50%
- ✓

6.2. INTERMEDIATE CERTIFICATION BASED ON THE RESULTS OF MASTERING THE DISCIPLINE

6.2.1. Form of intermediate certification – Zachet. Semester – IV

6.2.2. Procedure for intermediate certification - Withexamination

6.2.3. Examples of questions for preparing for the set-off

1. The modern concept of immunity.
2. Types of immunity.
3. Congenital (species) immunity.
4. Acquired immunity. Views.
5. The main differences between congenital and acquired types of immunity.
6. What factors are the non-specific protection of the body?
7. Which cells have phagocytic capacity?
8. What are the functions of phagocytic cells?
9. What are the stages of phagocytosis?
10. What happens at each stage of the phagocytic reaction?
11. What is incomplete phagocytosis? Completed?
12. What is a phagocytic number? Phagocytic index? How are they defined?
13. How is the phagocytosis completeness index determined?
14. Primary receptors for preimmune resistance.
15. Humoral factors of innate immunity.
16. Acute phase proteins
17. What is lysozyme? Method of determining lysozyme in saliva.
18. Complement, ways to activate complement. Biological role.
19. Similarities and differences in complement activation pathways.
20. Interferons. Variety. Functions.
21. Central and peripheral organs of the lymphoid system.

22. The principle of organization of the immune system.
23. Hematopoietic red bone marrow. Functions.
24. Thymus. Functions.
25. Peripheral organs of the lymphoid system. Functions.
26. Which cells are called "immunocompetent"?
27. Characteristics and functions of T-lymphocytes.
28. How and where does T lymphocyte differentiation occur?
29. Characteristics and functions of B-lymphocytes.
30. How and where does the differentiation of B-lymphocytes occur?
31. What are the similarities and differences in the functions of T and B lymphocytes?
32. What is the role of antigen-presenting cells?
33. Describe the NK cells.
34. What is an antigen? Give a definition.
35. Properties of antigens: antigenicity, foreignness, immunogenicity, specificity.

6.2.4. Exam ticket forms

Codes of controlled competencies: ID-1, ID-2 GPC-5

FSBEI HE DGMU

Ministry of Health of Russia

Department of Microbiology,
Virology and Immunology
in the direction of training
31.05.01 General Medicine
Discipline – Immunology

EXAM CARD No ____

1. History of immunology
2. Immunological memory: nature, biological significance. Differences between primary and secondary immune response
3. ROME, the principle of diagnostic value

Approved at the department, minutes dated "29" June 2022 Minutes No. 18

Omarova S.M. Doctor of Biological Sciences, Professor, Head of the Department of Microbiology, Virology and Immunology

Isaeva R.I. – Associate professor of the Department of Microbiology, Virology and Immunology

Saidova B.M. - Associate professor of the Department of Microbiology, Virology and Immunology

Compilers:
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Department of Microbiology,
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Korkmasova M.A. Ph.D., Associate Professor of the Department
microbiology, virology and
immunology __

"____"___

Codes of controlled competencies: ID-1, ID-2 GPC-5

FSBEI HE DGMU

Ministry of Health of Russia

Department of Microbiology,
Virology and Immunology
in the direction of training
31.05.01 General Medicine
Discipline – Immunology

EXAM CARD No ____

1. Antigen, definition, properties of antigen
2. Immunological tolerance, definition, species, biological significance
3. ELISA, the principle of application for the diagnosis of infectious diseases

Approved at the department, minutes dated "29" June 2022 Minutes No. 18

Omarova S.M. Doctor of Biological Sciences, Professor, Head of the Department of Microbiology, Virology and Immunology

Isaeva R.I. – Associate professor of the Department of Microbiology, Virology and Immunology

Saidova B.M. - Associate professor of the Department of Microbiology, Virology and Immunology

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Saidova B.M. Ph.D., Associate Professor, Associate Professor
Department of Microbiology,
Virology and Immunology __

Korkmasova M.A. Ph.D., Associate Professor of the Department
microbiology, virology and
immunology __

"__"__

6.2.5. The system of assessing the results of mastering the discipline, announcing the scales of assessment, grading.

Evaluation indicators	Evaluation criteria	
	"not counted"	**"credited"**
ID-1 GPC-5		
To know	The student is not capable of abstract thinking Does not know the basics of immunology	The student independently identifies the main provisions in the studied material and is able to give a brief description of the main ideas of the developed material of the discipline. Knows the subject, immunity, antigens, antibodies and other concepts of discipline. Shows a deep understanding of the subject of immunology.
can	The student does not know how to analyze the basic provisions of immunology	The student is able to use educational, scientific, popular science literature on the subject.
possess	The student does not know the basic basics of the subject	The student shows a deep and complete knowledge of the entire volume of the discipline studied, owns knowledge of immunology.
ID-2 GPC-5		
To know	The student is not capable of self-development and independent assimilation of the subject	The student independently fulfills the basic requirements for maintaining protocols of immunological studies
can	The student does not know how to independently state the basic concepts of immunology	The student knows and is able to apply allimmunological research methods.
possess	The student does not know the basic basics of immunology	The student fully owns the entire volume of the discipline being studied. Can use the received material on the subject.

VII. EDUCATIONAL - METHODOLOGICAL AND INFORMATION SUPPORT OF DISCIPLINE

7.1. Main literature

Print

№	Name of the publication	Number of instances in a library
1.	**Khaitov, R. M.** Immunology: Textbook for universities with a CD- - M.: GEOTAR - Media, 2011 - 320 p.	100
2.	1. Immunology and allergology / textbook for medical universities // Ed. by A.A. Vorobyov, A.S. Bykov, A.V. Karaulova.– M., Practical Medicine. – 2006. – 287 p.	100
3.	Medical Microbiology, Virology, Immunology / Ed. by Prof. L. B. Borisova. Textbook. - M.: Meditsina, 2001, 2002, 2005. - 528 p.	650

Electronic publications

№	Name of the publication
1.	Medical Microbiology, Virology and Immunology: in 2 vols. Volume 1. / ed. by V.V. Zverev, M.N. Boychenko. - M. : GEOTAR-Media, 2016. – 447 p. // Student consultant: student electronic library: electronic library system. – Moscow, 2019. – Access by password. - URL: http://www.studmedlib.ru/book/ISBN9785970436417.html
2.	Medical microbiology, virology and immunology. In 2 vols. Volume 2. / ed. by V.V. Zverev, M.N. Boychenko. - M. : GEOTAR-Media, 2016. – 447 p. // Student consultant: student electronic library: electronic library system. – Moscow, 2019. – Access by password. - URL: http://www.studmedlib.ru/book/ISBN9785970436424.html

7.2. Additional literature

Print

№	Name of the publication	Number of instances in a library
1.	**Drannik, G.N.** Clinical immunology and allergoldogy: for student courses, doctors, immunologists, allergists /G.N.Drannik.-M:MIA, 203.-604 p.	100
2.	**Khaitov, R.M.** Immunology: Atlas/ R.M.Khaitv, A.A.Yarilin, B.V.Pnegin// -M.:GEOTAR-Media, 2011.-624 p.	25
3.	A Guide to Practical Exercises in Microbiology, Immunology and Virology with Illustrated Tasks // pod. ed. by A.A.Vorobyov and V.N.Tsarev – M., MIA – 2007. – 470 p.	20
4.	2. Playfair J. Visual immunology. Lane. - M. - GEOTAR Medicine, 2000. - 95 p.	5
5.	Medical Microbiology, Virology and Immunology / textbook ed. by Prof. A.A. Sboychakova V.B.-SPb., M.-2008.-532 P.	60

Electronic publications

№	Name of the publication
1.	Microbiology, Virology and Immunology: A Guide to Laboratory Studies / ed. by V.B. Sboychakov, M.M. Karapats. - M. : GEOTAR-Media, 2015. (Doctor-specialist's library) // Consultant doctor: electronic medical library: electronic library system. – Moscow, 2019. – Access by password. – URL: http://www.studmedlib.ru/book/ISBN9785970435755.html.
2.	Microbiology, Virology and Immunology: A Guide to Laboratory Studies / ed. by V.B. Sboychakov, M.M. Karapats. - M. : GEOTAR-Media, 2014. (Doctor-specialist's library) // Consultant doctor: electronic medical library: electronic library system. – Moscow, 2019. – Access by password. – URL: http://www.studmedlib.ru/book/ISBN9785970430668.html.
3.	Microbiology, Virology: A Guide to Practical Exercises: Studies. posobie / pod red. V.V. Zvereva, M.N. Boychenko - M. : GEOTAR-Media, 2015. (Specialist Doctor's Department) // Consultant doctor: electronic medical library: electronic library system. – Moscow, 2019. – Access by password. – URL: http://www.studmedlib.ru/book/ISBN9785970434956.html.

4.	Fundamentals of Microbiology and Immunology / ed. by V.V. Zverev, M.N. Boychenko - M. : GEOTAR-Media, 2014. (Doctor-specialist's library) // Consultant doctor: electronic medical library: electronic library system. – Moscow, 2019. – Access by password. – URL: http://www.studmedlib.ru/book/ISBN9785970429334.html.
5.	Microbiology and immunology. Practicum: study. posobie / R. T. Mannapova - M. : GEOTAR-Media, 2013. (Doctor-specialist's library) // Consultant doctor: electronic medical library: electronic library system. – Moscow, 2019. – Access by password. – URL:http://www.studmedlib.ru/book/ISBN9785970427507.html.

7.3 Resources of the information and telecommunication network "Internet"

№	Resource name
1.	***For example:*** Electronic Library: Dissertation Library: Website / Russian State Library. – Moscow: RSL, 2003. – URL: http://diss.rsl.ru/?lang=ru (date of access: 25.01.2019). – Text: electronic.
2.	Government of the Russian Federation: official website. – Moscow. – Updated during the day. – URL: http://government.ru (date of access: 2019-02-19). – Text: electronic.
3.	Electronic library system "Student Consultant". Access mode: limited by login and password; http://www.studmedlib.ru
4.	Electronic library system "Doctor's Consultant". Access mode: limited by login and password; http//www.rosmedlib.ru
5.	State Central Scientific Medical Library; http://www.scsml.ru//
6.	Federal Electronic Medical Library
7.	Scientific electronic library "CYBERLENINKA"

7.4. Information Technologies

Software:

1. Microsoft Windows 10 Pro Operating System
2. Application packages:

Microsoft Office Standard 2016
It consists of:
Microsoft Word 2016, Microsoft Excel 2016, Microsoft Power Point 2016

3. Antivirus software – Kaspersky Endpoint Security 10 for Windows.

List of information help systems:

1. Electronic information and educational environment (LMS) of DSMU. URL: https://lms.dgmu.ru/
2. Student Advisor: Electronic Library System. URL: http://www.studentlibrary.ru
3. Physician Consultant: Electronic Library System. URL: http://www.rosmedlib.ru
4. Federal Electronic Medical Library (FEMB). URL: http://feml.scsml.rssi.ru
5. Scientific electronic library eLibrary. URL: https://elibrary.ru/defaultx.asp
6. Medical reference and information system. URL: http://www.medinfo.ru/
7. Scientific electronic library CyberLeninka. URL: http://cyberleninka.ru
8. Electronic library of the Russian Foundation for Basic Research. URL: http://www.rfbr.ru/
9. All-Russian educational Internet program for doctors. URL: http://www.internist.ru

VIII. MATERIAL AND TECHNICAL SUPPORT OF DISCIPLINE

No p/n	View of the room with room (classroom, laboratory, computer class) indicating the address (location) of the building, clinical base, structure, structure, premises, area of the room, its purpose.	Name of equipment
1.	Study room No1 (28^{m2}) St. Sh. Aliyev 1, 3rd floor. Forpracticalclasses, current control.	Laboratory tables for microbiological research. Cabinet with microscopes and special tools for practical exercises. Tables, diagrams.
2.	Study room No2 (46,5m2) St. Sh. Aliyev 1, 3rd floor. For practical training, current control. Electronic training, lecture classes.	Laboratory tables for microbiological research. Cabinet with microscopes and special tools for practical exercises. Tables, diagrams. Multimedia complex (laptop, projector, screen)
3.	Study room No3 (49^{m2}) St. Sh. Aliyev 1, 3rd floor. For practical training, current control.	Laboratory tables for microbiological research. Cabinet with microscopes and special tools for practical exercises. Tables, diagrams. Multimedia complex (laptop, projector, screen).
4.	Study room No4 (49^{m2}) St. Sh. Aliyev 1, 3rd floor. For practical training, current control, intermediate certification.	Laboratory tables for microbiological research. Cabinet with microscopes and special tools for practical exercises. Tables, diagrams.
5.	Study room No5 (63m^2) St. Sh. Aliyev 1, 3rd floor. For practical training, current control.	Laboratory tables for microbiological research. Cabinet with microscopes and special tools for practical exercises. Tables, diagrams. Multimedia complex (laptop, projector, screen).
6.	Study room No6 (28^{m2}) St. Sh. Aliyev 1, 3rd floor. For practical training, current control.	Laboratory tables for microbiological research. Cabinet with microscopes and special tools for practical exercises. Tables, diagrams.
7.	Laboratory (24^{m2}) St. Sh. Aliyev 1, 3rd floor. For laboratory work to practical exercises	Laboratory tables for microbiological research. Cabinet with dry nutrient media and reagents.
8.	Reading Room of the Scientific Library of DSMU St. Sh. Aliyeva1, 1st floor. For independent work.	Table, chairs, educational and scientific literature, computers with Internet access

IX. USE OF INNOVATIVE (ACTIVE AND INTERACTIVE) TEACHING METHODS

The active teaching methods used in the study of this discipline account for 5.5% of the volume of classroom classes.

1. Use the electronic text of lectures in the form of a word text editor document.
2. Use presentations made in Power Point.
3. Use of videos.

№	Name of the section (list those sections in which active and / or interactive forms (methods) of training are used)	Type, name of the topic of the lesson using the forms of active and interactive teaching methods	Labor intensity (hour)
1.	**Antigens. Classification. Views. Properties. Antibodies. Classes of immunoglobulins.**	L.3. Antigens, properties. Microbial antigens. Antigens of microorganisms. Antigens of the main histocompatibility complex.	2
2.	**Endogenous immunoregulators. Humoral and cellular immune response.**	L.4. Humoral and cellular immune response. Antibodies, classes of immunoglobulins, their characteristics. Hormones and mediators of the immune system.	1,5
3.	**Clinical immunology. Immunological memory. Immunological tolerance.**	L.5. Features of the immune response in various conditions. Immune response in bacterial, protozoal, fungal and viral infections. Immunological memory. Immunological tolerance. Transplantation and antitumor immunity.	1,5
4.	**Methods of studying the immune status. Immunodeficiencies. Autoimmune reactions and diseases.**	L.6. Immune status. Congenital and acquired immunodeficiencies. Methods of detection and correction.	1
5.	**Allergic reactions.**	L.7. Immunopathology. Immunological hypersensitivity (allergy). Autoimmune reactions and diseases.	1
	TOTAL		9

X. METODIC PROVISION OF DISCIPLINE

Methodological support of the discipline hasbeen developed in the form of a separate set of documents: "Methodological recommendations for lectures", "Methodological recommendations for practical classes", "Methodological recommendations for the student" in the form of an appendix towhose program of the discipline

XI.FEATURES OF THE ORGANIZATION OF DISCIPLINE TRAINING FOR PERSONS WITH DISABILITIES AND PERSONS WITH DISABILITIES

1 1.1. Education of disabled persons and persons with disabilities

If necessary, it is carried out by the department on the basis of an adapted work program using special teaching methods and didactic materials compiled taking into account the characteristics of psychophysical development, individual capabilities and the state of health of such students (students).

1 1.2. In order to master the curriculum of the discipline by disabled people and persons with disabilities, the department provides:

1) for disabled persons and persons with visual disabilities:

• placement in places accessible to students who are blind or visually impaired and in an adapted form of reference information on the schedule of training sessions;

• the presence of an assistant who provides the necessary assistance to the student;

• production of alternative formats of methodological materials (large print or audio files);

2) for persons with disabilities and persons with hearing disabilities:

• appropriate sound means of reproducing information;

3) for disabled persons and persons with disabilities who have disorders of the orno-motor apparatus:

• the possibility of unhindered access of students to educational premises, toilets and other premises of the department. In case of impossibility of unhindered access to the department, organize the educational process in a specially equipped center for individual and collective use of special technical means of training for disabled people and persons with disabilities (1 A. Aliyev Str., biological building, 1st floor).

11.3. Education of students with disabilities can be organized both jointly with other students and in separate groups.

1 1.4. The list of educational and methodological support for the independent work of students in the discipline.

Educational and methodological materials for the independent work of students from among the disabled and persons with disabilities are provided in forms adapted to the limitations of their health and perception of information:

Categories of students	Form
hearing impairment	- in printed form; - in the form of an electronic document
Visually impaired	- in printed form in an enlarged font; - in the form of an electronic document; - in the form of an audio file
With a violation of the op orno-motor apparatus	- printed form; - in the form of an electronic document

This list can be specified depending on the contingent of students.

1 1.5. Evaluation Funds Fund for Intermediate Certification of Students in the Discipline.

11.5.1. List of evaluation funds correlated with the planned results of the development of the educational program.

For students with disabilities

Categories of students	Types of valuation tools	Forms of monitoring and evaluation of learning outcomes
Hearing impaired	test	predominantly written verification
Visually impaired	interview	mainly oral inspection (individually)
With a violation of the op orno-motor apparatus	solution of remote tests, control inopdew	organization of control in LMS DSMU , written verification

Students with disabilities and persons with disabilities are given an increase in the time for preparing answers to the test, and are allowed to prepare for the test using distanceeducational technologies.

11.5.2. Methodical materials that describe the procedures for assessing knowledge, skills, abilities and (or) activitiesthat characterize the stages of the formation of competencies.

In carrying out the procedure for assessing the learning outcomes of persons with disabilities and persons with disabilities, it is envisaged to use the technical means necessary for them in connection with their individual characteristics.

The procedure for assessing the learning outcomes of persons with disabilities and persons with disabilities in the discipline provides for the provision of information in forms adapted to the limitations of their health and perception of information:

For visually impaired persons:

- in printed form in an enlarged font;
- in the form of an electronic document;
- in the form of an audio file.

For people with hearing impairments:

- in printed form;
- in the form of an electronic document.

For persons with disorders of the orno-motor system:

- in printed form;
- in the form of an electronic document;
- in the form of an audio file.

This list can be specified depending on the contingent of students.

When conducting the procedure for assessing the results of training of disabled persons and persons with disabilities in the discipline (module), the followinglegal requirements are met, depending on the individual characteristics of the students:

1. instructions on the procedure for conducting the assessment procedure shall be provided in an accessible form (orally, in writing, orally using the services of asurd operator);

2. an accessible form for providing tasks of evaluation tools (in printed form, in printed form in an enlarged font, in the form of an electronic document, the tasks are read out by the assistant, the tasks are provided using the surd op erevoda);

3. an accessible form for providing answers to tasks (written on paper, a set of answers on a computer, using the services of an assistant, orally).

If necessary, for students with disabilities and people with disabilities, the procedure for assessing the results of training in the discipline (module) can be carried out in several stages.

The procedure for assessing the learning outcomes of persons with disabilities and persons with disabilities is carried out using distance educational technologies.

1 1.6. List of basic andeducationalliterature necessary for the development of the discipline.

For the development of the discipline by persons with disabilities and persons with disabilities, basic educational literature is provided in the form of an electronic document in the library fund and / or in electronic library systems. As well as special textbooks and teaching aids, other educational literature and special technical means of training for collective and individual use, as well as the services of surdsof teachers and typhlosurd oeredivists.

1 1.7. Methodical instructions for students on mastering the discipline

In the development of discipline by disabled people and persons with disabilities, individual work is of great importance. Individual work means two forms of interaction with the teacher: individual educational work (consultations), i.e.individualclarification of the educational material and in-depth study of the material with those students who are interested in this, and individual educational work. Individual consultations on the subject are an important factor contributing to the individualization of training and the establishment of educational contact between the teacher and students with disabilities or students with disabilities.

11.8. Developmentof the material and technical base necessary for the implementation of the educational process in the discipline

The development of the discipline by disabled persons and persons with disabilities is carried out using the means of general and special purpose training:

- lecture hall - multimedia equipment, mobile radio class (for students with hearing impairments); power supplies for individual technical means;
- classroom for practical classes (seminars), multimedia equipment, mobile radio class (for students with hearing impairments);
- training room for independent work - standard workplaces with personal computers; workplace with a personal computer, with a screen access program, a screen zoom program and a braille display for students with visual impairment.

In each auditorium where disabled persons and persons with disabilities study, an appropriate number of places for students should be provided, taking into account their health limitations.

XII. CHANGE SHEET

Listof issuesand changes made to the work program of the discipline	RP updated at the meeting of the department		
	Date	**Number of minutes of the meeting of the department**	**Signature of the Head of the Department**
the following changes are made to the work program 1. .....; 2..... etc. or a note is made that it is not advisable to make any changes for this academic year			