

Microbiology, Virology

Syllabus

Department	Morphology and physiology	
Curriculum	s310501- ЛечДелюИИ-21-1.plx Specialty 31.05.01 General Medicine	
Qualification	General Practitioner	
Form of education	Full-time	
Total (in credits)	6	
Total academic hours	216	Control:
including:		Exams, 4 th term
Classes	128	
Self-study	61	
Control hours	27	

Course outline in terms

Academic year (Term)	2 (2.3)		2 (2.4)		Total	
	Weeks		Weeks			
Types of classes	Cur	Syl	Cur	Syl	Cur	Syl
Lectures	16	16	16	16	32	32
Practical	48	48	48	48	96	96
Classes total	64	64	64	64	128	128
Contact training	64	64	64	64	128	128
Self-study	44	44	17	17	61	61
Control hours			27	27	27	27
Total	108	108	108	108	216	216

The Syllabus is compiled by:

PhD in Biological Sciences (Biology), Senior Lecturer Kuyarov A.A. _____

The Syllabus

Microbiology, Virology

Developed in accordance with Federal State Educational Standard:

Federal State Educational Standard of higher education in the specialty 31.05.01 General medicine (Order of the Ministry of Education and Science of the Russian Federation on August, 12 2020. №988)

Based on the Curriculum:

31.05.01 GENERAL MEDICINE

Specialization: General Medicine

Approved by the Academic Council of Surgut State University, “16” June 2022, Record No.6

The Syllabus was approved by the department

Morphology and physiology

Head of Department, Doctor of Medicine, Professor Stolyarov V.V.

1. COURSE OBJECTIVES	
1.1	The aim of Microbiology, Virology in higher medical schools is to form consistent natural science-based world outlook, to master the knowledge of microbe world diversity and their role in common biological processes and in human pathologies by developing common cultural and professional competencies. The competencies are aimed at providing sanitary and epidemiological well-being of the population, preservation and improvement of its health.
1.2	The objectives of Microbiology, Virology are: to study the biology of infectious diseases agents and representatives of normal human microflora; to study etiology and usage of microbiological diagnostic methods and medications for specific prevention and therapy.

2. COURSE OVERVIEW	
Course Code (in curriculum)	B1.O.04.12
2.1 Assumed background:	
	Biochemistry
	Hominal Physiology
	Biology
	Physics, Mathematics
	Chemistry
	Medical Informatics
2.2 Post-requisite courses and practice:	
	Epidemiology
	Infectious Diseases
	Dermatovenerology
	Public Health and Healthcare, Economy of Public Health
	Hospital Therapy (the 5th year)
	Paediatrics, Childhood Infections

3. COMPETENCES UPON COMPLETION OF THE COURSE (MODULE)	
GPC-5.1 Knows the histological structure of organ tissues - knows how to differentiate them microscopically; the anatomy of the human body - the macroscopic structure and topography of organs and body parts; human physiology - the mechanisms of homeostasis regulation and the functional systems of the body in the normal condition	
GPC-5.5 Knows the structure and physiology of microorganisms, their role in the etiology of human diseases	
By the end of the course students must:	
3.1	know:
	- history of Microbiology, Virology, the main stages of the development of these Sciences;
	- regulations for safety and work in microbiological laboratories, with reagents and devices, laboratory animals;
	- classification, morphology and physiology of microbes and viruses, their biological and pathogenic properties, impact on public health;
	- features of process creation of symbiosis between the human body and microbes, the role of resident microflora in the development of opportunistic diseases;
	- features of pathogenicity and antibiotic resistance genetic control of microbes, development mechanisms of resistance and ways of its determination;
	- the role of individual representatives of the microbial world in the etiology and pathogenesis of major human infectious diseases;
	- methods of microbiological diagnostics, application of the main antibacterial, antiviral and biological medications, principles of their preparation and application.
3.2	be able to:
	- analyze the assessment results of morphofunctional, physiological states and pathological processes in the human body to solve professional problems;
	- diagnose the pathogenic agents of parasitic diseases on the specimen, slide, in the photo; perform microbiological and immunological diagnostics.
3.3	have skills of:

- the main methods of sterilization, disinfection and antiseptic treatment of tools and equipment to avoid infection of a doctor and a patient;
- methods of results interpretation of microbiological and immunological research, determination of antimicrobial activity of antibiotic medications and microbiologically reasonable rules of their application for treatment of patients;
- basic skills of working with material containing pathogenic and opportunistic microorganisms;
- methods of antimicrobial and immunobiological medications selection for the adequate prevention and treatment of infectious and non-infectious diseases;
- basic skills of working with modern devices used for the diagnostics of infectious diseases;
- preliminary diagnosis based on the results of laboratory examination (microbiological and immunological) of the adult population and adolescents.

4. STRUCTURE AND CONTENTS OF THE COURSE (MODULE)

Class Code	Topics /Class type	Term / Academic	Academic	Competences	Literature	Interactive	Notes
	Part 1. General Microbiology						
1	Module I. Morphology of microorganisms						
1.1	The subject and problems of medical microbiology and value of microbiology at the practical activities of the doctor. The basic stages of development of microbiology /Lecture/	3	2	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	
1.2	Lecture. The systematization and nomenclature of microorganisms. The basic groups of bacteria. Taxonomic systems of classification. Morphology and bacterial structure /Lecture/	3	2	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	
1.3	Work regulations in microbiological laboratory. The world of microbes. Taxonomy and classification of bacteria. Differences between procaryotic and eukaryotic cells /Practice/	3	3	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	Oral quiz, test, case-study, practical skills
1.4	Morphology and bacterial structure. Role of bacterial components of bacterial cells in vital activity of bacteria and pathogenesis of infectious diseases. /Practice/	3	3	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	2	Oral quiz, test, case-study, practical skills
1.5	Special methods of staining. Organization of biological microscope. The types of microscopy. The procedure of the immersion microscopy /Practice/	3	3	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	Oral quiz, test, case-study, practical skills
1.6	Morphology and ultrastructure of particular groups of bacteria: rickettsia, chlamidia, mycoplasma, actinomycetes, spirochetes, fungi, protozoa /Practice/	3	3	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	2	Oral quiz, test, case-study
1.7	The main periods in the development of microbiology. Research of L. Pasteur, R. Koch, I. Mechnikov and their role in foundation of microbiology and the development of world science. /Self -study/	3	14	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	
2	Module II. Physiology of microorganisms						

2.1	Bacterial metabolism. Respiration of bacteria. Classification of bacteria according to type of respiration. Anaerobes. Anaerobic culture methods of isolating anaerobic pure cultures. /Lecture/	3	2	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	
2.1	Achievements in microbiology. Modern methods of detection of pathogen-specific macromolecules. Detection of nucleic acid sequences: nucleic acid probe tests, polymerase chain reaction. /Lecture/	3	2	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	
2.2	Antibiotics. History of discovery. Role of A. Fleming. Classification. General criteria for effective antibiotic action. General principles of effective antibacterial therapy. /Lecture/	3	2	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	
2.3	Physiology of bacteria. Nutrient media. Sterilization, asepsis, antisepsis, disinfection. Methods of cultivation of the microorganisms and isolation of the pure bacterial cultures. Bacteriological method of the diagnostics of infectious diseases /Practice/	3	3	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	2	Oral quiz, test, case-study
2.4	Physiology of bacteria: nutrition, respiration, growth, multiplication, energy metabolism, enzymatic systems of bacteria. Bacteriological method of diagnostics of infectious diseases. Identification of pure cultures of microorganisms. Biochemical activity of bacteria. The bacteriological method of diagnostics of infectious diseases /Practice/	3	3	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	Oral quiz, test, case-study
2.5	The spread of microbes in the environment. Microflora of water, air, soil. Sanitary - bacteriological investigation of objects of environment: water, air, soil. Sterilization, disinfection, and antisepsis. Methods of sterilization /Practice/	3	3	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	Oral quiz, test, case-study, practical skills
2.6	Normal microbial flora of the human body and its functions. Methods of detection. Dysbiosis. The preparations for correction of normal microflora disorders (probiotics, prebiotics, symbiotic) /Practice/	3	3	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	
2.7	Genetics of microorganisms. Organization of the genetic bacterial apparatus. Genotypical and phenotypical variation of microorganisms, its practical significance. Mutations and genetic recombination's. Dissociation in bacteria. Bacteriophages. General characteristics. Structure and replication. /Practice/	3	3	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	2	Oral quiz, test, case-study, practical skills
2.8	Chemotherapeutical drugs, antibiotics. Determination of sensitivity of microorganisms to antibiotics /Practice/	3	3				Oral quiz, test, case-study, practical skills
2.9	The role of biological factors, such as bacteriophages, enzymes, serum, etc. The relationship of microbes in associations. Quorum sensing bacteria. The ability to form biofilm. /Self-study/	3	15	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	
3	Module III. Basic and applied immunology						

3.1	The study of infections. Dynamics of development of infectious diseases. /Lecture/	3	2	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	
3.2	Immune System. Structure and functions. Cells of the Immune System. Classification. Characteristics. Cooperation of immunocompetent cells in immune response /Lecture/	3	2	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	
3.3	Hypersensitivity of delayed type (DTH). Mechanisms. Important characteristics of the types of DTH reactions /Lecture/	3	2	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	
3.4	Infection. Infectious process. The factors of pathogenicity and virulence of bacteria. Biological method of diagnostics of infectious diseases /Practice/	3	3	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	2	Oral quiz, test, case-study
3.5	Factors of innate (natural) immunity. Nonspecific defense mechanisms: local and systemic. Complement system. Antigens and antibodies. Serological method of diagnostics of infectious diseases. Antigen-antibody reactions (agglutination reaction, passive hemagglutination reaction) /Practice/	3	3	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	2	Oral quiz, test, case-study
3.6	Immunity. Antigens and antibodies. Immune System. Structure and functions. Cells of the Immune System. Classification. Characteristics. Cooperation of immunocompetent cells in immune response. /Practice/	3	3	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	Oral quiz, test, case-study
3.7	Hypersensitivity of delayed type (DTH). Mechanisms. Important characteristics of the types of DTH reactions. Skin allergic tests /Practice/	3	3	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	Oral quiz, test, case-study
3.8	Genetic methods of identification (the detection of specific sequences of viral nucleic acids – DNA hybridization, polymerase chain reaction (PCR test)) /Practice/	3	2	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	Oral quiz, test, case-study
3.9	Serological method of diagnostics of infectious diseases. Precipitation reactions. Complement fixation test. Neutralization reaction. Serological identification (detection of specific viral antigens). Serological reactions with the labeled components: Immunofluorescent test (IFT), Enzyme-linked immunosorbent assay (ELISA), Immunoblotting (Western blot analysis), Radioimmunoassay (RIA) /Practice/	3	2	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	Oral quiz, test, case-study, practical skills
3.10	Estimation of immune status of the human organism. Immunoprophylaxis and immunotherapy: vaccines, sera, immune globulins, bacteriophages. Immunodiagnosis: diagnosticums, allergens, bacteriophages. /Practice/	3	2	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	Oral quiz, test, case-study
3.11	The normal human microflora and its role in physiological and pathological processes. Dysbiosis and risk factors /Self-study/	3	15	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	

Part 2. Special microbiology							
4	Module IV. Gastrointestinal tract infections						
4.1	Fundamentals of Clinical Microbiology. General Principles of bacteriological diagnosis of acute intestinal infections. /Lecture/	4	2	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	
4.2	Pathogenesis and methods of microbiological diagnosis of typhoid and paratyphoid /Lecture/	4	2	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	
4.3	Escherichia, systematic position, general characteristics. The biological role of Escherichia coli. Molecular mechanisms of escherichiosis pathogenesis. /Practice/	4	3	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	Oral quiz, test, case-study
4.4	Characteristics of immunity in typhoid and paratyphoid fever. Salmonella - causative agents of acute gastroenteritis. Shigella. Causative agents of dysentery, classification, general characteristics /Practice/	4	3	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	2	Oral quiz, test, case-study
4.5	Microbiological diagnostics of diseases caused by Klebsiella, Yersinia, Methods for food poisoning diagnostics /Practice/	4	3	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	Oral quiz, test, case-study
4.6	Microbiological diagnostics of diseases caused by Campylobacter and pseudomonads, biochemical characteristics, antigenic structure, determinants of pathogenicity /Practice/	4	3	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	Oral quiz, test, case-study
4.7	Vibrio cholerae, the systematic position. Classification and general characteristics, pathogenicity factors. Biovars. Differentiation from non-cholera vibrio. Pathogenesis of cholera. Methods of microbiological diagnostics /Practice/	4	3	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	2	Oral quiz, test, case-study,
4.8	Pseudomonas aeruginosa, general characteristics, pathogenicity factors. Role in human pathology /Self-study/	4	6	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	
5	Module V. Purulent-inflammatory diseases						
5.1	Microbiological diagnostics of diseases caused by staphylococci, streptococci, Neisseria /Lecture/	4	2	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	Oral quiz, test, case-study
5.2	Particularly dangerous infections. Classification mode, basic rules of sampling, sending and transportation of infectious material. General principles of diagnosis /Lecture/	4	2	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	Oral quiz, test, case-study
5.3	Methods of microbiological diagnostics of anaerobic infections /Lecture/	4	2	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	Oral quiz, test, case-study
5.4	Staphylococci, Streptococci general characteristics. Role in human pathology. Pathogenicity factors and mechanisms of pathogenesis of staphylococcal infections /Practice/	4	3	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	Oral quiz, test, case-study

5.5	The genus Clostridium. Classification. C. tetani., C. perfringens Taxonomy, general properties, determinants of pathogenicity, toxin production, transmission. Epidemiology. Clinical syndromes. Laboratory diagnosis. Treatment, prevention, and control. /Practice/	4	3	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	Oral quiz, test, case-study
5.6	Methods of microbiological diagnosis of diseases caused by mycobacteria and actinomycetes /Practice/	4	3	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	Oral quiz, test, case-study
5.7	Microbiological diagnostics of diseases caused by Corynebacterium, Bordetella, haemophiles, legionella, listeria /Practice/	4	3	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	Oral quiz, test, case-study
5.8	Microbiological diagnostics of especially dangerous infections /Practice/	4	3	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	Oral quiz, test, case-study
5.9	Microbiological diagnostics of diseases caused by spirochetes. The family Rickettsiaceae. Classification. General characteristics. Rickettsiosis. /Practice/	4	3	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	Oral quiz, test, case-study
5.10	The family Mycoplasmataccae. General characteristics. Classification. M.pneumoniae, M.hominis, Ureaplasma urealyticum. Pathogenesis and clinical disease of mycoplasmosis. /Self-study/	4	6	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	Oral quiz, test, case-study
6	Module VI. Viral infections						
6.1	Viruses. Structure and classification. Reproduction of viruses. Cultivation of viruses. Bacteriophages. Orthomyxoviruses (flu virus). Paramyxoviruses (parainfluenza, mumps, measles, respiratory syncytial virus). Adenoviruses /Lecture/	4	2	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	Oral quiz, test, case-study
6.2	Parenteral hepatitis viruses: classification, characteristics. Hepatitis B virus, Hepatitis C virus: pathogenesis, immunity, etiologic diagnostics, therapy, prevention. /Lecture/	4	2	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	Oral quiz, test, case-study
6.3	Retroviruses. Human immunodeficiency virus (HIV). HIV infection: pathogenesis, immunity, etiologic diagnostics, principles of therapy, prevention. /Lecture/	4	2	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	Oral quiz, test, case-study
6.4	Orthomyxoviruses. The influenza viruses. Structure. Classification. Pathogenesis and immunity of influenza virus infection. Nonspecific and specific defense mechanisms of anti influenza immunity, treatment, prevention, and control /Practice/	4	3	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	Oral quiz, test, case-study
6.5	Ecological group of arboviruses: definition, classification, characteristics. Arbovirus infection: features, pathogenesis. Tick-borne encephalitis: pathogenesis, etiologic diagnosis, prevention. Ecological arboviruses subgroup. Bunyaviruses, hemorrhagic fever with renal syndrome /Practice/	4	3	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	Oral quiz, test, case-study

6.6	Herpesviruses. Classification. General characteristics. Herpes simplex virus. Varicella-Zoster virus. Epstein-Barr virus. Cytomegalovirus. Epidemiology. Pathogenesis and clinical syndromes of herpesvirus infections. Laboratory diagnostics. Treatment and immunoprophylaxis. /Practice/	4	3	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	Oral quiz, test, case-study
6.7	Picornaviruses. Classification. General characteristics. Biological properties. Antigens. Role in human pathology. Coxsackieviruses. Echoviruses. Epidemiology. Pathogenesis and clinical disease. Laboratory diagnosis. Treatment. Prevention. Hepatitis viruses. Classification. Hepatitis B virus. General properties. Associated antigens. Epidemiology. Pathogenesis and clinical disease. Laboratory diagnosis. Treatment. Prevention: passive and active immunization. /Practice/	4	2	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	Oral quiz, test, case-study
6.8	Retroviruses. Human Immunodeficiency viruses (HIV). General characteristics. Acquired Immune Deficiency Syndrome (AIDS). Epidemiology. Pathogenesis. Clinical stages of HIV infection. Laboratory Diagnostics. Treatment. Immunoprophylaxis. Oncoviruses /Practice/	4	2	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	Oral quiz, test, case-study
6.9	Clinical microbiology. Microbiological diagnostics of sepsis and purulent infections of the skin /Practice/	4	2	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	Oral quiz, test, case-study
6.10	Prions and slow virus diseases. Structure of cellular and scrapie prion proteins. Resistance to physico-chemical factors. Functions of cellular prion protein. Pathogenic characteristics of scrapie prion protein. Model for proliferation of prions /Self-study/	4	5	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	
	Exam	4	27	GPC –5.1 GPC –5.5	1.1, 1.2, 1.3 2.1	0	Oral quiz

5. ASSESSMENT TOOLS

5.1. Tests and tasks

Supplement 1

5.2. Topics for written papers

Supplement 1

ASSESSMENT TOOLS

Supplement 1

5.4. List of assessment tools

1. Points for oral quiz
2. Test
3. Case-study
4. Practical skills

6. COURSE (MODULE) RESOURCES

6.1. Recommended Literature

6.1.1. Core

	Authors	Title	Publish., year	Quantity
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1.1	Artamonova M.N., Potaturkina-Nesterova N.I., Ilyina N.A., Nemova I.S.	Medical Microbiology, Virology and Immunology. Lecture Notes [Electronic resource]: textbook	M: GEOTAR-Media, 2020.	https://www.studentlibrary.ru/book/ISBN9785970455289.html
1.2	Zverev V.V., Boichenko M.N.	Medical Microbiology, Virology, Immunology: textbook. Vol. 1 [Electronic resource]	in 2 volumes. - M: GEOTAR-Media, 2020.	https://www.studentlibrary.ru/book/ISBN9785970456071.html
1.3	Khaitov R.M	Immunology [Electronic resource]: Textbook	2nd updated edition. Moscow: GEOTAR-Media, 2021	https://www.studentlibrary.ru/book/ISBN9785970458617.html

6.1.2. Supplementary

	Authors	Title	Publish., year	Quantity
2.1	Khaitov R.M.	IMMUNOLOGY [Electronic resource]:	Moscow: GEOTAR-Media, 2008.	https://www.studentlibrary.ru/book/ISBN9785970407042.html

6.2. Internet resources

Э1	Free Medical Journals
Э2	http://iprbookshop.ru/
Э3	http://e.lanbook.com/
Э4	http://www.znaniium.com
Э5	http://www.studmedlib.ru/

6.3.1 Software

6.3.1.1	Operational system Microsoft, applied programs pack Microsoft Office
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6.3.2 Information Referral systems

6.3.2.1	"Guarantor", "Consultant plus",
6.3.2.2	Student Consultant http://www.studmedlib.ru

8. Course manuals

Supplement 1

ASSESSMENT TOOLS

Syllabus

Microbiology, Virology

Qualification

Specialist

Specialty

31.05.01 General Medicine

Form of education

Full-time

Designer Department

Morphology and physiology

Graduate Department

Internal diseases

Sample tasks and tests

Stage I: Formative assessment.

GENERAL MICROBIOLOGY

Module I 'Morphology of microorganisms'

1.1 Points for oral quiz.

1. Work regulations (rules of work) in microbiological laboratory
2. The world of microbes
3. Special features of structure of prokaryotic and eukaryotic cells
4. Taxonomy and classification of bacteria, basic taxonomic categories
5. Morphology and ultrastructure of a bacterial cell
6. Microscopic method of infectious diseases diagnostics
7. Morphological and tinctorial properties of microorganisms
8. Basic forms (shapes) of bacteria
9. Simple and complex methods of bacteria staining
10. Mechanism and steps of staining by Gram method

1.2 The list of practical skills

1. To make a smear from the colony of investigated bacteria
2. To make a smear from liquid investigated material or bacteria suspension
3. To stain a smear by simple method
4. To stain a smear by complex method: Gram method
5. To stain a smear by complex method: Ziehl-Neelsen method
6. To stain by Loeffler's method to reveal the volutine granules
7. To stain by Burry-Gins method to reveal the capsule
8. To microscope smears with the oil immersion system of light microscope, to make identification of the microorganisms due to their morphological and tinctorial properties to genus or family

Module II 'Physiology of microorganisms'

1.1 Points for oral quiz.

1. Composition of nutrient media
2. Requirements used for nutrient media
3. Classification of nutrient media according to their composition and initial components
4. Classification of nutrient media according to their purpose (assignment)
5. Classification of nutrient media according to their consistence
6. The conception of asepsis and antisepsis, their types
7. The conception of disinfection methods, disinfection and disinfection efficiency
8. The conception of sterilization, methods, equipment and regimes of sterilization
9. Methods of determining the sterilization efficiency

10. The conception of species, strain, colony, pure culture of microorganisms
11. Methods of isolation of the pure bacterial culture of microorganisms
12. Bacteriological method of infectious diseases diagnostics. The purpose and sequence of the 1st stage of bacteriological method of aerobic bacteria isolation
13. The technique of inoculation of microorganisms on the liquid and solid media
14. The features of anaerobic microorganisms' cultivation.
15. Equipment used for cultivation of anaerobic bacteria
16. Metabolism of bacteria
17. Enzymatic systems of microorganisms
18. Classification of bacteria according to the nutrition types. The sources of carbon, nitrogen, macro- and microelements, growing factors for microbes
19. Mechanisms of entering nutritional substances into the bacterial cell of bacteria
20. Classification of bacteria according to the sources of energy

1.2 The list of practical skills:

1. To carry out the inoculation of the studied material with bacteriological loop on the solid nutrient medium in the Petri dish with the purpose of pure culture isolation
2. To make inoculation of an isolated colony (pure culture of bacteria) from Petri dish with MPA on the slant agar and Resell's medium (medium of accumulation)
3. To make inoculation of wound discharges on the Kitt-Tarozzi medium and high column of sugar MPA
4. To list cultural properties of colonies, grown on Ploskirev's and Endo's media in case of suspicion on dysentery and colienteritis
5. To list cultural properties of pathogenic staphylococcus colonies grown on blood MPA and yolk-salt agar
6. To make inoculation of isolated pure culture of bacteria on the media for biochemical identification
7. To make account of the results and general conclusion upon biochemical identification of isolated pure culture of bacteria

Topic 'Ecology of microbes. Genetics of microorganisms'

1.1 Points for oral quiz.

1. Sanitary microbiology. Representatives and basic characteristics of sanitary - indicative microorganisms of water, air and soil
2. Microflora of water, air and soil
3. Methods of detection of sanitary-indicative microorganisms of water
4. Methods of detection of air microflora
5. Methods of detection of soil microflora
6. Normal microflora of different biotopes of human organism
7. Functions of normal microflora of the human body
8. Methods of examination of the human microflora
9. Definition of the concept 'dysbacteriosis', its causes
10. Principles of dysbacteriosis diagnostics and treatment

1.2 The list of practical skills:

1. To determine coli-index of water by the fermentative method
2. To determine coli-index of water by the membrane filters method

3. To determine air microflora by the sedimentation method
4. To determine total microbial amount of water
5. To determine total microbial amount of soil
6. To interpret the results of the intestine microflora investigation for dysbiosis
7. Solving of case-studies

Topic 'Basis of the antimicrobial chemotherapy' and 'Infection and infection process'

1.1 Points for oral quiz.

1. Basic groups of chemotherapeutical drugs and antibiotics
2. Mechanisms of action of antibiotics on microorganisms
3. Side effects of antibiotics
4. Mechanisms of resistance to antimicrobial agents
5. Methods of sensitivity detection of microorganisms to antibiotics
6. Concept 'infection' and 'infectious disease'
7. Forms of symbiosis
8. Classification of infectious diseases and forms of infection
9. Periods and results of infectious diseases
10. Pathogenicity and virulence of bacteria, units of virulence
11. Basic factors of pathogenicity of microorganisms
12. Microbial toxins
13. Biological method of diagnostics of infectious diseases

1.2 The list of practical skills:

1. To determine spectrum of antibiotics activity
2. To detect sensitivity of microorganisms to antibiotics by the disc diffusion method (Kirby-Bauer' method; qualitative method)
3. To detect sensitivity of microorganisms to antibiotics by the method of serial dilutions in liquid medium (quantitative method)
4. To detect sensitivity of microorganisms to antibiotics by the E-test
5. To take into account the results of revealing the pathogenicity factors of staphylococci: the presence of hemolytic and lecithinase activity and plasmocoagulase
6. To take into account the results of toxigenicity detection of *Corynebacterium diphtheriae*
7. To determine capsulated bacteria in prepared smears

Module III 'Basic and applied immunology'

1.1 Points for oral quiz.

1. Definition of the concept 'immunity'. Kinds of immunity.
2. Cell-mediated factors of innate immunity (nonspecific resistance).
3. Phagocytosis: phagocytes' cells, mechanism of action, stages.
4. Morphofunctional characteristic of the NK-cells
5. Humoral factors of innate immunity (nonspecific resistance).
6. Definition of the concept 'antigen'. Properties of antigens. Kinds of antigens
7. Definition of the concept 'antibody'. Structure of antibodies (immunoglobulins) molecules. Proper-

ties of antibodies classes

8. Immunological reactions: definition, using for diagnostics of infectious diseases
9. Agglutination reaction: definition, mechanism, variants
10. Mechanism of passive haemagglutination reaction. Erythrocyte diagnostics

1.2 The list of practical skills:

1. To carry out and to take into account slide agglutination test for determination of enteropathogenic E.coli antigens
2. To carry out Wright's reaction in diagnostics of brucellosis
3. To take into account Wright's reaction in diagnostics of brucellosis
4. To take into account passive haemagglutination reaction with "pair" (couple) sera in diagnostics of dysentery
5. To carry out and take into account thermoprecipitation reaction by Ascoli in diagnostics of anthrax (with the purpose of detection of Bacillus anthracis antigens in the testing material)
6. To take into account gel diffusion precipitation test with the purpose of determination of toxin production of Corynebacterium diphtheriae (neutralization test of toxin with antitoxic serum)
7. To take into account complement fixation test (CFT) in serological examination of epidemic typhus
8. To take into account ready-made (demonstrative) Enzyme-linked immunosorbent assay with the purpose of revealing antibodies in serum of blood in diagnostics of HIV-infection
9. To take into account Mancini radial immunodiffusion reaction to detect quantity of immunoglobulins in serum of patients' blood
10. To take into account the reaction of complement titration with the aim of estimating the serum complement activity

SPECIAL MICROBIOLOGY

Module IV-V Gastrointestinal tract infections and purulent-inflammatory diseases

1.1 Points for oral quiz.

1. Staphylococci, general characteristics. The role in human pathology. Pathogenicity factors and mechanisms of pathogenesis of staphylococcal infections. Microbiological diagnosis. Principles of treatment and prevention of staphylococcal infections
2. Streptococci, classification. General characteristics. Pathogenicity factors. Antigenic structure. Pathogenesis, immunity, microbiological diagnosis, principles of treatment and prevention of streptococcal infections
3. Classification of Neisseria. Meningococcus, general characteristics. Meningococcal infections, mechanisms of pathogenesis, immunity, methods of diagnostics, prevention
4. Gonococci, general characteristics. Mechanisms of pathogenesis and immunity. Microbiological diagnostics of acute and chronic gonorrhoea

5. General characteristics of the family Enterobacteriaceae
6. General Principles of bacteriological diagnostics of acute intestinal infections (All). The nutrient medium for enterobacteria. Classification principles of application
7. Materials for researches in All diagnostics
9. E. coli, common characteristic. The biological role of Escherichia coli. Diseases caused by Escherichia
10. Salmonella. General characteristics. Members of the genus. Serological classification by Kaufmann-White. Molecular biological typing
11. Pathogens of typhoid, paratyphoid A and B, general characteristic. Phage typing. Vi-antigen and its value
12. Pathogenesis and methods of microbiological diagnostics of typhoid and paratyphoid
13. Immunity in typhoid fever. Serological diagnostics of typhoid and paratyphoid. Specific prophylaxis
14. The etiology of food poisoning and intoxication of bacterial origin. Materials and methods of diagnostics
15. Salmonellosis. Characteristics of pathogens and diagnostic methods. Nosocomial salmonellosis
16. Shigella. Classification. Characteristics. Pathogenesis, immunity. Methods of microbiological diagnostics of acute and chronic dysentery
17. Klebsiella. Classification, general characteristics. Pathogenesis, immunity, methods of microbiological diagnostics of klebsiellosis
18. Pseudomonas aeruginosa, general characteristics, pathogenicity factors. The role in human pathology
19. Pathogens of intestinal yersiniosis, general characteristics. Pathogenesis. Methods of diagnostics of yersiniosis
20. C. diphtheria, general characteristics. Differences from non-pathogenic corynebacteria. Mechanisms of pathogenesis and microbiological diagnosis of diphtheria
21. Diphtheria toxin and its properties. Toxoid. Immunity in diphtheria and its character. Determination of antitoxic immunity. Principles of therapy and prevention of diphtheria
22. The causative agent of whooping cough, general characteristics. Differentiation with parapertussis agent. Pathogenesis, immunity. Microbiological diagnosis, principles of treatment and prevention of pertussis
23. General characteristics of the causative agents of tuberculosis. Pathogenesis, immunity, diagnostics and specific prevention of tuberculosis. Mycobacteriosis
24. The causative agent of leprosy. Characteristic, pathogenesis, immunity
25. Particularly dangerous infections. Classification mode, basic rules of sampling, sending and transportation of infectious material. General principles of diagnosis TELO

26. V. cholera. Systematics. General characteristics. Differentiation of biovars. Pathogenesis, immunity, principles of treatment and prevention. Methods of microbiological diagnostics
27. The causative agent of plague, a general characteristic. The pathogenesis of plague. Immunity, the principles of therapy and prevention of plague
28. B. anthracis characteristic. Pathogenesis, immunity, principles of treatment and prophylaxis of anthrax
29. The causative agent of tularemia, general characteristic. Pathogenesis, immunity, principles of treatment and prophylaxis of tularemia
30. Pathogens of brucellosis, a general characteristic. Differentiation of Brucella species. Pathogenesis, immunity, principles of treatment and prevention of brucellosis
- 31 Spirillae family. Campylobacter, characteristics, the role in human pathology. Helicobacter
32. Classification and general characteristics of anaerobes. Clostridia. Bacteroides, Peptococci and other nonspore anaerobes. Pathogenicity factors. The role in human pathology
33. The causative agent of tetanus, general characteristics. Pathogenesis, immunity, principles of treatment and prevention of tetanus
34. Gas gangrene pathogens, general characteristics. Pathogenesis, principles of treatment and prevention of gas gangrene
35. The causative agent of botulism, general characteristic. Pathogenesis, principles of botulism prevention and therapy. Clostridial gastroenteritis
36. Methods of diagnostics of anaerobic infections
37. Classification and general characteristics of spirochetes
38. Classification of treponemes and treponemal diseases. Characteristics of syphilis causative agent. Pathogenesis, immunity, diagnostic tests for syphilis
39. Leptospire. General characteristics. The pathogenesis of leptospirosis, immunity, specific prevention. Microbiological diagnostics of leptospirosis
40. Borrelia, general characteristics. Recurrent fever pathogenesis, immunity. Microbiological diagnostics. The causative agent of Lyme borreliosis
41. Systematic position and characterization of Rickettsia. Pathogenesis, immunity, methods of diagnostics of typhus
42. Characteristics of chlamydia. Causative agents of trachoma, psittacosis, respiratory and urogenital chlamydiosis. Pathogenesis and methods of diagnosis of chlamydia
43. General characteristics of mycoplasma, pathogenicity factors, the role in human pathology. Methods of mycoplasmosis diagnostics

Module VI Viral infections

1.1 Points for oral quiz.

1. Classification and taxonomy of viruses
2. Morphology and ultrastructure of viruses
3. Features of viral genome structure
4. Stages of interaction of a virus with a host cell
5. Methods of viruses' cultivation
6. Types of tissue (cell) cultures
7. Stages of virological method of diagnostics
8. Methods of indication of viruses (the detection of virus growth)
9. Reaction of inhibition of haemagglutination (RIHA)
10. Reaction of neutralization (RN)
11. Complement fixation test (CFT)
12. Influenza virus
13. Parainfluenza virus
14. Epidemic parotitis (mumps) virus
15. Measles virus
16. Rubella virus
17. Herpes viruses (HSV I, II, Varicella zoster virus, Cytomegalovirus, Epstein-Barr, etc)
18. Adenoviruses
19. Polioviruses
20. Coxsackie viruses
21. Rabies virus
22. Vesicular stomatitis virus
23. Hepatitis A, B, C, D, E virus
24. HIV

Module I-VI: Sample tests for formative assessment.

1. To name the morphological and tinctorial properties of staphylococci:

- A. Gram positive nonsporing, noncapsulated, nonmotile cocci arranged in grape-like clusters
- B. Gram negative nonsporing, noncapsulated, nonmotile cocci arranged in grape-like clusters
- C. Gram positive nonsporing, noncapsulated, nonmotile cocci arranged in chains
- D. Gram negative nonsporing, noncapsulated, nonmotile cocci arranged in chains
- E. Gram positive nonsporing, with microcapsule, nonmotile cocci arranged in grape-like clusters

2. To name the elective medium (media) for isolation of staphylococci:

- A. Alkaline MPB and MPA
- B. Blood MPA
- C. Bile agar
- D. Yolk-salt agar
- E. Milk-salt agar

3. To list the factors of pathogenicity of staphylococci:

- A. Exotoxins
- B. Endotoxins
- C. Extracellular enzymes
- D. Cell surface proteins
- E. Cell associated polymers

4. To list the exotoxins of staphylococci:

- A. Haemolysin
- B. Leikocidin
- C. Enterotoxin
- D. Toxic shock syndrome toxin
- E. Exfoliative (epidermolytic) toxin

5. To point out the extracellular enzymes of staphylococci:

- A. Coagulase
- B. Hyaluronidase
- C. Fibrinolysin
- D. Nucleases (DNA-ase, RNA-ase)
- E. Proteinases

6. To point out the extracellular enzymes of staphylococci:

- A. Lecithinase
- B. Lipases
- C. Urease
- D. Catalase
- F. β -lactamases

7. Lecithinase activity of bacteria is detected by inoculation of them onto nutrient medium (media):

- A. Sugar MPA
- B. Milk-salt gar
- C. Blood agar
- D. Yolk-salt agar
- E. Endo's medium, MacConkey's medium

8. Haemolytic activity of bacteria is detected by inoculation of them onto nutrient medium (media):

- A. Sugar MPA
- B. Milk-salt gar
- C. Blood agar
- D. Yolk-salt agar
- E. Endo's medium, MacConkey's medium

9. To point out what kind(s) of lesions can be caused by staphylococci:

- A. Wound infection

- B. Venereal diseases
- C. Pyogenic-inflammatory lesions
- D. Toxin-mediated illnesses
- E. All mentioned above

10. Staphylococcus aureus are responsible for the following disease(s):

- A. Skin, mucosa and soft tissue infections
- B. Osteomyelitis and arthritis
- C. Infections of a respiratory tract and the paranasal sinuses
- D. Toxin-mediated illnesses (food poisoning, toxic shock syndrome, scalded skin syndrome)
- E. Sepsis, central nervous system infections

Module I-VI: Case-study for formative assessment (with keys).

1. During bacteriological investigation of vomiting, stomach washing waters and the remains of food, Gram positive bacillus with rounded ends, polymorph, slow-mobile, anaerobic were isolated. Micro-organism makes colonies of irregular form with extensions on glucose-blood agar, causes erythrocytes haemolysis and produces exotoxin. *What agent was isolated?*

– *Proteus vulgaris*.

– *Bacteroides fragilis*.

– *Clostridium perfringens*.

+ *Clostridium botulinum*.

– *Salmonella typhimurium*.

2. It is necessary to make urgent botulism prophylaxis to a patient after eating infected product. What preparation should be used for this aim?

– Placenta gamma globulin.

– Monovalent botulinic antitoxic serum.

+ Polyvalent botulinic antitoxic serum.

– Toxoid.

– Interferon.

3. After eating home-made tinned vegetables, 2 cases of poisoning, characterised by CNS infection (seeing objects double, swallowing pain, aphonia) were recorded in a family. Name the probable food intoxication agent.

- Staphylococcus.
- + Botulism agent.
- Shigella.
- Salmonella.
- E. coli.

4. In kindergarten, after eating cottage cheese, a disease characterised by acute nausea, vomiting, diarrhoea was registered. During microscopy of preparation, made of cottage cheese and vomiting, Gram positive microorganisms in form of grape-like clusters were detected. What are your further actions for determination of the etiology of this food intoxication outbreak?

- + To make further bacteriological investigation.
- To determine antibodies in blood serum additionally.
- To make an additional allergic test.
- To conclude that staphylococcus was the reason of the disease.
- To make investigation of kitchen equipment.

5. During identification of food toxic infection agent, it was determined that the agent belongs to Salmonella genus according to biochemical properties. What agent feature will allow determining this specific belonging most precisely?

- + Antigen structure.
- Study sensitivity to antibiotics.
- Pathogenesis for different species of laboratory animals.
- Serological type of agent toxin.
- Phage typing.

Stage II: Midterm assessment exam

Midterm assessment is carried out in the form of exam. Tasks for the exam include three theoretical points.

Tasks for competence assessment «Knowledge»	Task type
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<p>List of theoretical points for oral quiz</p> <ol style="list-style-type: none"> 1. Definition of microbiology as the science. Branches of microbiology: general, medical, veterinary, technical, agricultural, ocean, space microbiology. Medical microbiology and its sections: bacteriology, virology, protozoology, mycology. 2. Stages of development of Microbiology, its branches. Medical Microbiology. History and scope. Impact in Microbiology made by L. Pasteur. R.Koch as the founder of microbiology. 3. Origin and evolution of microorganisms. Modern classification of procaryotes. Bacterial taxonomy. Main taxons. species as the main taxonomic unit. Bacterial taxonomy. 4. Morphology and bacterial structure. Role of bacterial components of bacterial cells in vital activity of bacteria and pathogenesis of infectious diseases. Differences between procaryotic and eukaryotic cells. 5. Cell envelope. Components. Cell wall. Structure in Gram-positive and Gram-negative bacteria. Functions. Differential stains. Gram's stain. 6. Study of morphology of bacteria. Optical methods: oil immersion microscopy, phase contrast microscopy, dark ground microscopy. Staining of bacteria. 7. Capsule. Functions. Demonstration of capsule. Capsular stain. India ink method (after Burri-Gience). Spores. Structure of spores. Function. Formation of spores. Types of bacterial spores. Spore stain. Modified acid fast techniques (Gansen's method). 8. Staining of bacteria. Dyes used in microbiology. Differential stains. Gram's stain. Principle. Procedure. Mechanisms: chemical and physical theories. 9. Spirochetes. Taxonomy, classification, general properties, morphological structure. The most common pathogens. 10. Bacterial methabolism. Nutritional requirements of bacteria. Culture media. The basic requirement to culture media. Classification of media. 11. Cultivation of viruses. Animal inoculation indication of the viruses in inoculated animals. 12. Discovery of viruses. Main stages in the development of virology. Modern classification of viruses. 13. Acid fast bacteria. Ziehl Neelsen stain. Principle and technique. 14. Bacterial metabolism. Respiration of bacteria. Classification of bacteria according to type of respiration. Anaerobes. Anaerobic culture methods of isolating anaerobic pure cultures. 15. Viral replication. Relationship between the virus and the host cell. Stages of viral replication. Replication cycle of human DNA viruses. Replication cycle of human RNA viruses. 16. Protoplasts, spheroplasts, L.forms of bacteria. Morphology, type of growth. Role in the human pathology. 17. Chlamydiae. Classification. C.psittaci, C.trachomatis, C.pneumoniae. General properties. Life cycle. Cultivation of chlamydiae. 18. Morphology of Rickettsia. Methods of staining of Rickettsia. 19. Metabolism of microorganisms. Bacterial nutrition. Classification of bacteria on the basis of nutritional requirements. 20. Metabolism and the conversion of energy Respiration of bacteria. Anaerobes. Methods of anaerobic culture. Anaerobic jar. GASPAK. 21. Bacterial growth and multiplication. Phases of bacterial growth, starting with an inoculum of stationary phase cells. Enzymes of microorganisms. Role of enzymes in metabolism, the conversion of energy and pathogenicity of bacteria. 22. History of discovery of viruses. D.I.Ivanovsky as the founder of virology. Stages of development of virology. Morphology and viral ultrastructure. Types of 	<p>-theoretical</p>
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symmetry. Chemical composition. Functions of viral subunits.

23. Viruses. Definition and properties. Classification. Morphology of viruses. Virion structure. Chemical properties. Functions of viral components. Culture and isolation of viruses.

24. Sterilization, disinfection, and antiseptics. Methods of sterilization. Methods of disinfection. Classification of disinfectants. Chemical disinfectants.

25. Antibiotics. History of discovery. Role of A.Fleming. Classification. General criteria for effective antibiotic action. General principles of effective antibacterial therapy.

26. Normal microflora of the human body. Role of normal microflora in the physiological and pathological processes. Gnotobiology. Role of I.I. Mechnikov in the development of study of normal microflora. Dysbacteriosis and causes of its origin.

27. The notion of chemotherapy and chemotherapeutic agents. Chemotherapeutic index. Mechanism of antibacterial action of Sulfonamides. Role of P.Erlach and T.Domagk in the development of study of chemotherapy.

28. Extra chromosomal genetic elements of bacteria. Plasmids, their properties and classification. Transposable genetic elements: insertion sequences and transposons.

29. Clinical microbiology. Collection and transport of clinical specimens. Specimen containers and their transport. Handling of specimen in the laboratory. Selection of laboratory investigations.

30. Achievements in microbiology. Modern methods of detection of pathogen-specific macromolecules. Detection of nucleic acid sequences: nucleic acid probe tests, polymerase chain reaction.

31. Modern views on the nature and origin of viruses. Position of viruses in the system of the living. Means of classification and naming of viruses. Families of DNA viruses. Families of RNA viruses. Some important members.

32. Bacteriophage. History of its discovery. General characteristics. Structure and replication. Types of bacteriophage infection: virulent (lytic) and temperate (lysogenic) infections. Phage typing of bacteria. Using bacteriophages for phage therapy and phage prophylaxis.

33. Host defenses against viral infection: natural barriers, nonspecific immune defenses, antigen-specific immune responses. Viral immunopathogenesis.

34. Viral detection: hemadsorption, hemagglutination. Hemagglutination inhibition test. Mechanism and technique. Interpretation of results.

35. The family Mycoplasmataceae. classification. General characteristics. Morphological properties and culture. Staining of mycoplasma.

36. Protozoa. Classification. General characteristics. Morphological properties. Microscopic detection: blood samples, tissue samples, sputum samples. Specimen collection. Examination. The Romanovsky-Giemsa staining.

37. Basic concepts in immunity. Central and peripheral organs of the Immune System. Inductive and productive phases of immune response.

38. Basic concepts in Infection. Role of microorganisms in infectious process. Pathogenicity. Virulence. Factors predisposing to microbial pathogenicity. Doses and methods of their detection.

39. Immune System. Structure and functions. Cells of the Immune System. Classification. Characteristics. Cooperation of immunocompetent cells in immune response.

40. Live attenuated vaccines, principles of preparation, control. Practical use of live vaccines. Efficiency.

41. The study of infection. Dynamics of development of infectious diseases. Periods. Classification of infection: carriage, reinfection, superinfection, relapse (recurrence) of infections.

42. Toxoides, their preparation, purification, units of measurement, use, efficiency.
43. Antibodies. Immunoglobulin types and structures. Antibody response: primary versus secondary (anamnestic) responses. Dynamic. Autoantibodies. Monoclonal antibodies. Hybridomas.
44. Efficacy of antiparasitic immune responses.
45. Bacterial resistance to antibacterial agents: acquisition of bacterial resistance, mechanisms of bacterial resistance, bacterial resistance according to drug class. Antibiotic susceptibility. Minimal inhibitory concentration (MIC): methods for MIC determination, tube dilution, Kirby- Bauer disk diffusion test.
46. Hypersensitivity of delayed type (DTH). Mechanisms. Important characteristics of the types of DTH reactions. Skin allergic tests.
47. Immunity. Modern determination of the notion of "Immunity". Stages of the development of immunology. Types of immunity and forms of its manifestation.
48. Nonspecific defense mechanisms. Phagocytosis. Phagocytic cells. Steps of phagocytosis. Complete and incomplete phagocytosis.
49. Immunoglobulin classes, their structure and properties. Complete and incomplete antibodies. Immunoglobulin specificities.
50. Nonspecific defense mechanisms: local and systemic. The complement system: components of complement (C), classical and alternative pathways of C activation, biological effects of C, deficiencies of the complement system.
51. Interferons and antiviral agents. Classes of antiviral agents. Sites of action of antiviral compounds. Types of interferons. Mechanism of action. Clinical uses. Resistance to antiviral agents.
52. Genetics of microorganisms. Organization of the genetic bacterial apparatus. Genotypical and phenotypical variation of microorganisms, its practical significance. Dissociation in bacteria.
53. Precipitation reaction. Mechanism of precipitation. Applications of precipitation reaction. Electroimmunodiffusion.
54. Reactions with "labelled" antibodies and antigens. Immunofluorescence: direct and indirect. The flow cytometer.
55. Serologic testing. General considerations. Clinical applications. Interpretation. Complement fixation tests. Technique, purpose, and clinical examples.
56. Serologic testing in virology. General considerations. Virus neutralization tests. Techniques. Practical guidelines.
57. Bacterial mutation. Origins. Types. Detection. Mutation repair mechanisms. Mutation suppression.
58. Types of vaccines. Classification. Recombinant vaccines. DNA vaccines.
59. Humoral immune response. Steps of the antibody production. Primary and secondary (anamnestic) responses. Immunological memory, its mechanism.
60. Immunology of malignancy. Tumour antigens. Immune response in malignancy. Immunotherapy of cancer.
61. Passive immunoprophylaxis and immunotherapy. Immune sera and immunoglobulins. Classification. Principles of preparing. Titration of antitoxic serum. Complication of usage of immune sera: anaphylactic reaction, serum sickness.
62. The notion of gene pool, genotype, and phenotype. Types of variation in bacteria.
63. Antibiotic susceptibility testing. Minimal inhibitory concentration (MIC). Methods for MIC determination: tube dilution, Kirby-Bauer technique, B-lactamase tests.
64. Bacterial resistance to antibacterial agents: intrinsic and acquired resistance. Basic mechanisms of resistance to antibiotics. Mutation and transfer of

resistance genes among bacteria.

65. Agglutination reaction. Mechanism of agglutination. Passive agglutination tests. Applications of agglutination reaction.

66. Genetic engineering and biotechnology. Common enzymes used in molecular biology (restrictases, polimerases, reverse transcriptases, lygases). Cloning of foreign DNA in vectors.

67. Cultivation of viruses. Embryonated eggs. Structure. Technique of inoculation of specimens. Detecting viral growth in embryonated eggs.

68. Essence of antiviral immunity. Humoral immunity. Cell-mediated immunity. Pathologic consequences of the antiviral immune response. Evasion of the immune response.

69. Antigens. Complete antigens and haptens. Determinants of antigenicity. Antigenic structure of bacteria. Antigenic structure of viruses.

70. The phenomenon of antagonism in microbes. Antibiotics, their definition. Classification of antibiotics according to their points and mechanisms of action.

71. Enzyme-linked immunosorbent assay (ELISA). Radioimmunoassay (RIA). Western blot analysis. Mechanisms and applications of the reactions.

72. Infection. Definition. Classification of infection. Types of infectious diseases: endemic, epidemic, and pandemic diseases. Sources of infection in man. Methods of transmission of infection: contact, inhalation, ingestion, inoculation, insects

73. Vaccines. Classification. Immunization schedules. Killed (inactivated) vaccines. Vaccines as immunotherapeutic agents.

74. Characters of pathogens. Pathogenicity, virulence. Bacterial virulence factors: capsules, adhesions, exoenzymes, toxins, invasiveness. Study the virulence and toxigenicity of microorganisms.

75. Structure and function of immune system. Central lymphoid system. Thymus. Functional classification of T cells. Bone marrow. Bursa of Fabricius. Peripheral lymphoid system: lymph nodes, spleen. Cells of lymphoreticular system.

76. Toxigenicity of microorganisms. Bacterial toxins. Distinguishing features exotoxins and endotoxins. Genetic basis of bacterial pathogenicity.

77. Laboratory diagnosis of viral infections. Culture and isolation. Serology. DNA hybridization.

78. Viral Genetics. Viral genomes. Viral mutation. Interaction between viruses. The role of genetic variation in the evolution of viruses.

79. Laboratory diagnosis of bacterial infections. Microscopic examination of patient specimens. Detection of pathogen-specific macromolecules. Culture and isolation of microorganisms. Serologic testing.

80. DNA transfer between bacteria. Conjugation. Transformation. Transduction.

81. Hypersensitivity. Classification of hypersensitivity reaction. Immediate hypersensitivity. Reaginic (anaphylaxis), cytolytic and cytotoxic types of reactions. Immune complex disease (serum sickness). Mechanisms and mediators.

82. Immunodeficiency diseases. Primary immunodeficiency. Classification of primary immunodeficiency syndromes. Secondary immunodeficiency.

83. Activators and stimulators of immune functions: cytokines, lymphokines, and chemokines. Sources, major targets, and functions.

84. Salmonella. Classification. *S. typhi*, *S. paratyphi A* and *paratyphi B* as the causative agents of enteric (typhoid and paratyphoid) fever. General properties. Determinants of pathogenicity. Pathogenesis and clinical disease. Epidemiology. Immunity. Laboratory diagnosis. Diagnosis of carriers. Treatment. Control and prevention.

85. Shigella. Taxonomy. Classification. General characteristics. Antigenic structure. Determinants of pathogenicity. Epidemiology. Pathogenesis and immunity of

dysentery. Clinical syndromes. Laboratory diagnosis. Treatment, prevention, and control.

86. The family Micrococcaceae. Taxonomy, general properties, classification. The genus *Staphylococcus*. Classification, structure, culture, biochemical characteristics, antigenic structure, resistance to physico-chemical factors, determinants of pathogenicity. Pathogenesis and clinical disease. Laboratory diagnosis of staphylococcal infections. Immunity. Treatment. Control and prevention.

87. The Rickettsiaceae family. Classification. General characteristics. Epidemic typhus. *R. prowazekii*: antigenic structure, determinants of pathogenicity, epidemiology, transmission, pathogenesis, and clinical disease, laboratory diagnosis, treatment, prevention, and control.

88. The Enterobacteriaceae family. Taxonomy, general properties. Classification. The genus *Escherichia*: culture, biochemical characteristics, antigenic structure, determinants of pathogenicity. Enteropathogenic *E. coli* Role in the human's pathology. Laboratory diagnosis of enterocolitis.

89. The genus *Neisseria*, general characteristics and classification. *N. meningitidis* *N.gonorrhoeae*. : classification, culture and isolation, determinants of pathogenicity. Pathogenesis and clinical disease. Epidemiology, immunity. Laboratory diagnosis. Treatment. Chemo- and immunoprophylaxis. Differentiation of the meningococci and nasopharyngeal Gram negative diplococci.

90. The genus *Streptococcus*: general properties, classification. *Streptococcus pneumoniae* (the pneumococcus): general properties, classification, virulence factors. Pathogenesis and clinical disease. Epidemiology. Laboratory diagnosis Treatment. Control and prevention.

91. Chlamydiae. Classification. General properties. Life cycle. Determinants of pathogenicity. *C. trachomatis*. Serotypes. *C. pneumoniae*. *C. psittaci*. Clinical disease. Epidemiology. Laboratory diagnosis. Treatment. Control and prevention.

92. The genus *Streptococcus*: general properties, classification. Group A streptococci (*S. pyogenes*). Group B streptococci (*S. agalactiae*). Determinants of pathogenicity: proteins, capsule, exotoxins, hemolysins, spreading factors. Pathogenesis and clinical disease of streptococcal infections. Laboratory diagnosis. Treatment. Control and prevention.

93. *Leptospira*. General properties. Classification. Pathogenesis and clinical disease of leptospirosis. Laboratory diagnosis. Epidemiology. Treatment and prevention

94. Mycobacteria. The most significant human pathogens. *M.tuberculosis*. General properties. Culture and isolation, identification. Determinants of pathogenicity. Pathogenesis and clinical disease of tuberculosis. Epidemiology. Laboratory diagnosis. Treatment. Control and prevention. Mycobacteria other than tuberculosis.

95. The genus *Bacillus*. Classification. Defining characteristics. *B.anthraxis*. Determinants of pathogenicity. Anthrax. Pathogenesis and clinical disease. Epidemiology. Laboratory diagnosis. Treatment. Control and prevention.

96. The family Mycoplasmataceae. General characteristics. Classification. *M.pneumoniae*, *M.hominis*, *Ureaplasma urealyticum*. Pathogenesis and clinical disease of mycoplasmosis. Immunity. Epidemiology. Laboratory diagnosis. Treatment, prevention, and control.

97. Pathogenic Protozoa, their biological properties. Taxonomy of kingdom Protozoa. Classification. Role in the human pathology. *Toxoplasma gondii*. Morphological properties. Life-cycle. Epidemiology. Pathogenesis and clinical disease of toxoplasmosis. Laboratory diagnosis. Treatment, prevention, and control.

98. The family Vibrionaceae. Taxonomy, general properties. Classification. *Vibrio cholerae* 01 and 0139. Culture, biochemical characteristics, antigenic structure, determinants of pathogenicity, epidemiology. Pathogenesis and clinical dis-

ease of cholera. Laboratory diagnosis. Treatment, prevention, and control. *Vibrio parahaenolyticum*. *Vibrio vulnificus*.

99. The family Enterobacteriaceae. Classification. The genus *Klebsiella*: *K.pneumoniae*, *K.ozoenae*, *K. rhinoscleromatis*. Taxonomy, general properties, structure, biochemical characteristics, antigenic structure, determinants of pathogenicity, epidemiology. Pathogenesis and clinical disease. Laboratory diagnosis. Treatment, prevention, and control.

100. The genus *Yersinia*. *Y.pestis*, *Y.enterocolitica*, *Y.pseudotuberculosis*. Taxonomy, general properties, resistance to physico-chemical factors, determinants of pathogenicity. Plague. Epidemiology. Pathogenesis and clinical disease. Laboratory diagnosis. Treatment, prevention, and control.

101. The genus *Clostridium*. Classification. *C.tetani*. *C.perfringens*. Taxonomy, general properties, resistance to physico-chemical factors, determinants of pathogenicity, toxin production, transmission. Pathogenesis and immunity of tetanus. Epidemiology. Clinical syndromes: generalized, localized, and neonatal tetanus. Laboratory diagnosis. Treatment, prevention, and control.

102. The genus *Francisella*. *F. tularensis*. Taxonomy, general properties. Determinants of pathogenicity. Transmission. Clinical symptoms of tularemia. Laboratory diagnosis. Treatment, prevention, and control.

103. Anaerobic bacteria. General characteristics. Classification. Non-spore-forming Gram-positive cocci (*Peptostreptococcus*) and Gram-negative bacilli (*Bacteroides*, *Prevotella*, *Fusobacterium*). Epidemiology. Virulence factors. Pathogenesis. Clinical manifestations. Laboratory diagnosis. Treatment.

104. The family Spirochaetaceae. General properties. Classification. The genus *Borrelia*. *B.recurrentis*. (Epidemic relapsing fever). *B.burgdorferi*. (Lyme disease). Determinants of pathogenicity, epidemiology, pathogenesis, and clinical disease. Laboratory diagnosis of epidemic relapsing fever and Lyme disease. Treatment, prevention, and control.

105. The genus *Bordetella*. The genus *Corynebacterium*. *C. diphtheriae*. Taxonomy, classification, general properties, resistance to physico-chemical factors, toxin production, transmission. Pathogenesis and clinical symptoms of diphtheria. Laboratory diagnosis. Treatment and immunoprophylaxis.

106. The family Spirochaetaceae. Classification. The genus *Treponema*. *T.pallidum*. General properties. Determinants of pathogenicity. Syphilis. Pathogenesis and clinical disease. Epidemiology. Immunity. Laboratory diagnosis. Treatment.

107. *Campylobacter* and *Helicobacter*. General properties. Classification. Determinants of pathogenicity. Epidemiology. Gastroenteritis caused by *C.jejuni*. Gastritis, gastric peptic ulcers, and gastric carcinoma associated with *H.pylori*. Pathogenesis and clinical disease. Laboratory diagnosis. Noninvasive tests of urease activity. Treatment.

108. The family Rickettsiaceae. Classification. General characteristics. Rickettsiosis. Classification. Q fever. Epidemiology. Pathogenesis and clinical presentation. Laboratory diagnosis. Treatment and immunoprophylaxis.

109. Paramyxoviruses. Classification. General characteristics. Measles virus. Mumps virus. Parainfluenza virus. Respiratory syncytial virus. The genus *Rubivirus*. General characteristics. Epidemiology. Clinical disease. Laboratory diagnosis. Treatment. Prevention.

110. Adenoviruses. General characteristics: structure, serotypes. Epidemiology. Pathogenesis and clinical disease. Laboratory diagnosis. Treatment. Prevention.

111. Poxviruses. Classification. Structure. Smallpox, cowpox, and monkeypox. Epidemiology, clinical disease. Laboratory diagnosis. Prevention. Declaration of the World Health Organization: the world «smallpox-free».

112. Retroviruses. Human Immunodeficiency viruses (HIV). General characteris-

tics. Acquired Immune Deficiency Syndrome (AIDS). Epidemiology. Pathogenesis. Clinical stages of HIV infection. Laboratory Diagnosis. Treatment. Immunoprophylaxis.

113. Picornaviruses. Classification. General characteristics. Biological properties. Antigens. Role in human's pathology. Coxsackie viruses. Echoviruses. Epidemiology. Pathogenesis and clinical disease. Laboratory diagnosis. Treatment. Prevention. Newer enteroviruses.

114. Rhabdoviruses. General properties. Rabies. Epidemiology. Pathogenesis and clinical disease. Treatment. Control and prevention.

115. Orthomyxoviruses. The influenza viruses. Structure. Classification. Pathogenesis and immunity of influenza virus infection. Non-specific and specific defense mechanisms of anti influenza immunity, treatment, prevention, and control. Severe acute respiratory syndrome (SARS).

116. Polioviruses. Classification. General characteristics. Poliomyelitis. Epidemiology. Pathogenesis. Immunity. Clinical disease. Laboratory diagnosis. Prevention.

117. Hepatitis viruses. Classification. Hepatitis B virus. General properties. Associated antigens. Epidemiology. Pathogenesis and clinical disease. Laboratory diagnosis. Treatment. Prevention: passive and active immunization.

118. Arboviruses. Classification. Main families and genera of Arboviruses. General characteristics. Pathogenesis of arbovirus infections. Yellow fever. Dengue fever. Encephalitis. Viruses associated with hemorrhagic fever. Filoviruses (the Marburg virus and the Ebola virus). Epidemiology. Pathogenesis and clinical diseases. Laboratory diagnosis. Control and prevention.

119. Herpesviruses. Classification. General characteristics. Herpes simplex virus. Varicella-Zoster virus. Epstein-Barr virus. Cytomegalovirus. Epidemiology. Pathogenesis and clinical syndromes of herpesvirus infections. Laboratory diagnosis. Treatment and immunoprophylaxis.

120. Hepatitis viruses. Classification. Hepatitis C virus (HCV), hepatitis D virus (HVD), hepatitis G virus (HGV) and other. Pathogenesis and clinical disease. Immunity. Laboratory diagnosis. Treatment and prevention.

121. Hepatitis viruses. Classification. Hepatitis A virus (HAV). Hepatitis E virus (HEV). General characteristics. Epidemiology. Pathogenesis and clinical disease. Laboratory diagnosis of hepatitis A and hepatitis E. Immunity. Treatment. Prevention.

122. The family Picornaviridae. Cardio-viruses. Epidemiology. Pathogenesis. Clinical syndroms. Laboratory diagnosis. Treatment. Prevention.

123. The family Picornaviridae, Rhinoviruses. Epidemiology, clinical syndromes. Laboratory diagnosis. Treatment. Prevention.

124. Oncogenic viruses. General principles of viral oncogenesis. Proviruses and oncogenes. Mechanism of malignant transformation. DNA tumor viruses. RNA tumor viruses. Identifying viral oncogenic behavior.

125. Prions and slow virus diseases (prion diseases). Structure of cellular and scrapie prion proteins. Resistance to physico-chemical factors. Functions of cellular prion protein. Pathogenic characteristics of scrapie prion protein. Model for proliferation of prions. Epidemiology, pathogenesis and clinical syndromes of prion diseases. Laboratory diagnosis. Treatment, prevention, and control.

METHODOLOGICAL GUIDELINES FOR LEARNING OUTCOMES ASSESSMENT

Stage: Formative assessment

Formative assessment is a regular checking of student academic progress during the academic term. It is performed in various oral and written forms (quizzes, essays, checking of home assignments, compilation of cases, self-study, colloquiums, and testing). During formative assessment, the teacher monitors the level of student's academic progress according to the curriculum identifying lack of knowledge, or misunderstanding.

The tasks of formative assessment are aligned with the Curriculum and Syllabus.

1. Guidelines for assessing the oral quiz:

In assessing the teacher takes into account:

- knowledge and understanding of the subject matter;
- activity during the class;
- consistency of presentation;
- argumentation of the answer, the level of independent thinking;
- ability to link theoretical and practical principles with future professional activity.

Assessment criteria:

The results are assessed in a four-grading scale: "excellent", "good", "satisfactory", "unsatisfactory".

Type of the task	Assessed competences	Assessment criteria	Grade
Oral answer	GPC –5.1 GPC –5.5	The student demonstrates a comprehensive, systematic and in-depth knowledge of the academic material; has learned the required and additional resources. The student demonstrates a consistent and thorough understanding of the required knowledge, concepts, skills of the material learned, and their significance for future profession.	Excellent
	GPC –5.1 GPC –5.5	The student demonstrates a comprehensive knowledge of the academic material; has learned the required and additional resources. The student demonstrates a consistent understanding of the required knowledge, concepts, skills of the material learned, but makes minor errors.	Good

	GPC –5.1 GPC –5.5	The student demonstrates basic knowledge necessary for further study; has learned basic recommended literature. The student operates with inaccurate formulating, has difficulties in the independent answers, makes significant mistakes but is able to correct them under the guidance of a teacher.	Satisfactory
	GPC –5.1 GPC –5.5	The student does not know the obligatory minimum or demonstrates gaps in knowledge of the academic material, makes major mistakes or gives completely wrong answers.	Unsatisfactory

2. Guidelines for case-study assessment:

Assessment criteria:

The results are assessed in a four-grading scale: “excellent”, “good”, “satisfactory”, “unsatisfactory”.

Type of the task	Assessed competences	Assessment criteria	Grade
Case - study	GPC –5.1 GPC –5.5	The student correctly and solves the case-study task, demonstrating deep knowledge. There are no errors in logical reasoning and solution, the problem is solved in a rational way. The right answer is obtained, ways are clearly described.	Excellent
		The student correctly solves the case-study task, demonstrating deep knowledge. There are minor errors in logical reasoning and solution, the problem is solved in a rational way. The right answer is obtained, ways are clearly described.	Good
		The student correctly solves the case-study task, demonstrating basic knowledge. There are significant errors in logical reasoning and solution. The student demonstrates difficulties, but	Satisfactory

		still is able to solve a case-study task.	
	GPC –5.1 GPC –5.5	The student incorrectly solves the case-study task, makes significant mistakes. The student is not able to solve a case-study.	Unsatisfactory

3. Guidelines for test assessment.

Assessment criteria:

The results are assessed in a four-grading scale: “excellent”, “good”, “satisfactory”, “unsatisfactory”.

Type of the task	Assessed competences	Assessment criteria	Grade
Test	GPC –5.1 GPC –5.5	80 – 100%	Excellent
		66 – 80%	Good
		46 – 65%	Satisfactory
		Less Than 46%	Unsatisfactory

4. Guidelines for the assessment of practical skills:

Assessment of practical skills based on simulation or participation of third parties may include a demonstration of manipulation, response to the questions of the task;

- assessment of practical skills at the bedside may include a demonstration of detection and / or interpretation of signs, symptoms, methods of examination and treatment;

-the task may include a brief introduction, questions, and list of practical skills for demonstration (according to Curriculum).

In assessing the teacher takes into account:

- knowledge and understanding of the subject matter;
- ability to apply theoretical knowledge into practice;
- the level of formed practical skills;
- reasoning and response style;

- rationale for data selection, additional tests, differential diagnosis and/or choice of treatment, level of clinical thinking.

Assessment criteria:

The results are assessed in a four-grading scale: “excellent”, “good”, “satisfactory”, “unsatisfactory”.

Type of the task	Assessed competences	Assessment criteria	Grade
Practical skills	GPC –5.1 GPC –5.5	The student correctly demonstrates practical skills on the model with a deep knowledge of the material. There are no mistakes in the demonstration and the used technique. The indications and conditions used in this method are clearly described.	Excellent
		The student demonstrates practical skills on the model with slight inaccuracies. There are insignificant mistakes in the demonstration and the used technique. The indications and conditions used in this method are clearly described.	Good
		The student demonstrates practical skills on the model with inaccuracies. There are significant mistakes in the demonstration and the used technique. The indications and conditions used in this method are clearly described.	Satisfactory
	GPC –5.1 GPC –5.5	The student demonstrates practical skills on the model with signifi-	Unsatisfactory

		cant mistakes. The indications and conditions used in this method are not described.	
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Stage II: midterm assessment (exam)

Methodological guidelines for summative assessment (exam)

Examination is held in the oral form and includes several stages:

- oral answer (the card includes three questions);

Requirements for the student:

- 1) regularly attend classes; the absence from classes is not allowed without good reason;
- 2) in case of absence from classes the student has to work out passed classes;
- 3) the student has to hand over written papers on time;
- 4) the student has successfully passed all colloquiums provided by the plan;
- 5) in case the student has been negatively assessed on the colloquium, he/she should try to pass it again;
- 6) during the test week the student has to hand over all the tasks (clinical case).

The students are allowed to take examinations in case of all the tests passed and no academic debts (on the basis of the academic records).

The students are not allowed to take examination:

- with unpassed tests on the discipline;
- with missed classes, debts on the discipline;
- with 5 (five) and more debts for the previous term;
- with one debt for earlier terms for more than a year.

Recommendations for the examination assessment:

Type of the task	Assessed competences	Assessment criteria	Grade
Oral quiz	GPC –5.1 GPC –5.5	The student demonstrates comprehensive, systematic and profound knowledge of the subject, can independently perform the tasks provided by the program; who has a good knowledge of the main literature and familiar with the additional literature recommended by the program; demonstrates creative abilities in understanding, statement and use of material of the studied discipline, faultlessly answers not only questions of the card, but also additional questions within the main program, correctly performs a practical task.	Excellent
	GPC –5.1 GPC –5.5	The student has good knowledge of material of the studied discipline; can successfully perform the tasks provided by the program; has a good knowledge of the main literature recommended by the program; answers all questions of the card, correctly performs a practical task, but makes some mistakes.	Good
	GPC –5.1 GPC –5.5	The student demonstrates knowledge of material for further	Satisfactory

		study; can cope with the tasks provided by the program; familiar with the main recommended literature; makes mistakes when performing examination tasks, but has necessary knowledge for their elimination under the supervision of the teacher.	
	GPC –5.1 GPC –5.5	The student demonstrates poor knowledge of the material, makes significant mistakes in performance of the tasks provided by the program.	Unsatisfactory

Chart of the examination grade assessment:

Tasks	Assessed competences	Grade	Score
Theoretical point № 1 (Oral quiz)	GPC –5.1 GPC –5.5	Excellent	5
		Good	4
		Satisfactory	3
		Unsatisfactory	2
Theoretical point № 2 (Oral quiz)	GPC –5.1 GPC –5.5	Excellent	5
		Good	4
		Satisfactory	3
		Unsatisfactory	2
Theoretical point № 3 (Oral quiz)	GPC –5.1 GPC –5.5	Excellent	5
		Good	4
		Satisfactory	3
		Unsatisfactory	2

Total	GPC –5.1	Excellent	15-13
	GPC –5.5	Good	12-10
		Satisfactory	9-6
		Unsatisfactory	5-0