

MINISTRY OF HEALTH OF UKRAINE  
KHARKIV NATIONAL MEDICAL UNIVERSITY

Department of Microbiology, Virology and Immunology named by prof. D.P. Grynyov

Academic year 2021-2022

**SYLLABUS OF THE EDUCATIONAL COMPONENT  
MICROBIOLOGY, VIROLOGY AND IMMUNOLOGY**

Normative educational component

Full-time form of education

Field of knowledge 22 "Health care"

Specialty 222 "Medicine"

Educational and professional program "Microbiology, virology and immunology"

The second (master's) level of higher education

2<sup>nd</sup> year

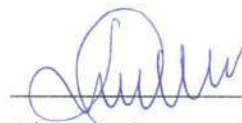
The syllabus of the discipline was approved at  
the meeting of the department

Microbiology, virology and immunology  
named by D. P. Grynyov

Protocol from

"30" August 2021 № 14

Head of Department

 prof. Mishyna M.M.  
(signature) (surname and initials)


"30" \_ August\_\_ 2021

Approved by the methodical commission of  
KhNMU on the problems of general and pre-  
professional training

Protocol from

"31" August 2021 № 1

Chairman of the methodical commission

 prof. Vovk O.Yu.  
(signature) (surname and initials)

"31" \_ August\_\_ 2021

### **EDUCATIONAL DESIGNERS:**

Maryna M. Mishyna, Head of Department of Microbiology, virology and immunology named by D. P. Grynyov, DM, Professor

Iryna A. Marchenko, teacher of Department of Microbiology, virology and immunology named by D. P. Grynyov, PhD

Information about teachers:

Name	Position	Email
Maryna Mishina	Professor, Head of the department, MD	mm.mishina@knmu.edu.ua
Yulia Mozgova	PhD, Associate Professor	ya.mozghova@knmu.edu.ua
Olena Kotsar	PhD, Associate Professor	ov.kotsar@knmu.edu.ua
Olexandra Vovk	PhD, Associate Professor	oo.vovk@knmu.edu.ua
Natalia Kovalenko	PhD, Associate Professor	ni.kovalenko@knmu.edu.ua
Olena Kochneva	PhD, senior teacher	ov.kochnieva@knmu.edu.ua
Tetiana Kovalenko	PhD, senior teacher	ti.kovalenko@knmu.edu.ua
Natalia Popova	PhD, senior teacher	nh.popova@knmu.edu.ua
Evhenia Shtanyuk	PhD, teacher	ya.shtaniuk@knmu.edu.ua
Olena Dubovyk	PhD, teacher	os.dubovyk@knmu.edu.ua
Olena Hopta	PhD, teacher	ov.hopta@knmu.edu.ua
Hanna Isaieva	teacher	ho.isaieva@knmu.edu.ua
Iryna Marchenko	PhD, teacher	ia.marchenko@knmu.edu.ua
Olha Bondarenko	PhD, teacher	ov.bondarenko@knmu.edu.ua

**Contact phone and E-mail of the department:**. tel.(057) 707-73-62,  
[kaf.7med.mikrobiolohii@knmu.edu.ua](mailto:kaf.7med.mikrobiolohii@knmu.edu.ua)

**Consultations:** schedule and venue according to the schedule of the department.

**Online consultations:** schedule and venue by prior arrangement with the teacher.

**Location:** classes are held at the Department of Microbiology, virology and immunology named by D. P. Grynyov KhNMU, remotely - in Google Meet, Moodle, ZOOM, Microsoft Teams.

## INTRODUCTION

The syllabus of the discipline "Microbiology, Virology and Immunology" is compiled in accordance with the educational program "Medicine" and the Standard of Higher Education of Ukraine at the Master's level, field of knowledge - 22 healthcare, specialty 222 "Medicine"

### Description of the discipline

135 hours and 4.5 ECTS credits are allocated for the study of the academic discipline during 2nd year (20 hours for lectures, 60 hours for practical classes and 55 hours for student's independent work).

### General characteristic of the course

The discipline "Microbiology, Virology and Immunology" studies the origin, evolution and properties of pathogenic microorganisms, the role of normal microflora of the human body, relationship between microorganisms and macroorganisms, immune system and mechanisms of immune response to bacterial, viral, fungal and protozoan infections, diagnostic methods, management principles and specific prophylaxis of infectious diseases.

The course program determines the prerequisites for access to education, orientation and main focus of the program, the amount of ECTS credits required for a master's degree, a list of general and special (professional) competencies, normative and variable content of training, formulated in terms of learning outcomes and control requirements quality of higher education.

The department accepts qualified students of any race, national or ethnic origin, gender, age, people with special needs, any religion, sexual orientation, gender, veteran status or marital status for all rights, privileges, programs and activities, provided to university students.

### Aim and tasks of studying the course

The purpose of studying microbiology, virology and immunology is determined by the ultimate goals set on the basis of program training for doctor in the specialty in accordance with the block of its sections (scientific training), and is the basis for building the content of the discipline. The description of goals is formulated through skills in the form of target tasks (actions). On the basis of the ultimate goals for each section, specific goals are formulated in the form of certain skills (actions), target tasks that ensure the achievement of the ultimate goal of studying the discipline.

**Discipline status:** normative Discipline format: mixed (provides traditional forms of classroom learning in combination with elements of e-learning with support in the Moodle, GoogleMeet, Microsoft Teams and Zoom system.

### Teaching methods:

- visual and practical (illustration, demonstration, experiment);
- informative (presentation, video, methodical instructions, lectures);
- scientific (participation in scientific research of department)
- control (testing, situational tasks, evaluation of practical skills).

### Prerequisites and co-requisites.

The discipline "Microbiology, Virology and Immunology" are related to such disciplines as Medical Biology, Human Anatomy, Histology, Cytology and Embryology, Latin, Pathophysiology, Pathomorphology, General Hygiene, Epidemiology, Immunology and Allergology.

### Teaching outcomes

Outcomes of studying the discipline "Microbiology, Virology and Immunology" the student must be able to:

- Assess the state of the microbiocenosis of the human body;
- Interpret the results and perform serological tests in infectious diseases of general profile;
- Interpret the results and conduct microbiological studies of biological fluids and secretions;
- Anticipate the negative effects of dangerous factors on the human body;
- Master modern methods of microbiological research in infectious diseases of general profile;
- Analyze the principles of obtaining vaccines and immune sera, methods of their standardization and control, practical use;
- Demonstrate mastery of moral and ethical principles of attitude to a living person, his body as an object of anatomical and clinical research.

The study of the discipline provides students with the acquisition of the following program learning outcomes:

acquisition by a person of general and special fundamental and professionally-oriented knowledge, skills, abilities, competencies necessary for the performance of typical professional tasks related to his / her activity in the medical field in the relevant position

ability to apply the acquired knowledge, skills and understanding to solve typical problems of the doctor, the scope of which is provided by lists of syndromes and symptoms, diseases, emergencies, laboratory and instrumental research, medical manipulations

evaluation of patient intake, physical examination, laboratory and instrumental research data

ability to apply the acquired knowledge about the existing health care system to optimize their own professional activities and participate in solving practical problems of the industry.

The study of the discipline provides students with the following soft skill:

1. Ability to speak out
2. Emotional intelligence (the ability to recognize the emotions and motives of others)
3. Flexibility and acceptance of criticism
4. Analytical mind
5. Ability to see and solve a problem
6. Learn
7. Willingness to perform routine work
8. Ability to make decisions
9. Responsibility

**INFORMATION ABOUT THE DISCIPLINE  
"MICROBIOLOGY, VIROLOGY AND IMMUNOLOGY"**

Name indicators	Field of knowledge, direction of training, educational and qualification level	Characteristics of the academic discipline	
		full-time education	
Number of credits - 4.5	Educational program for training specialists of the second (master's) level of higher education training 22 "Health"	Mandatory component	
The total number of hours is 135	Specialty: 222 "Medecine"	<b>Year of preparation:</b>	
		2-d	
		<b>Semester</b>	
		4-th	
		<b>Lectures</b>	
		20 h	
		<b>Practical classes</b>	
		60 h	
		<b>Laboratory</b>	
		-	
		<b>Independent work</b>	
		55 h	
Hours for day (or evening) form of study: classroom - 80 independent student work - 55	Educational and qualification level: master	<b>Individual tasks:</b>	
		Type of control: <b>Credit</b>	

**2.1 The content of the discipline**

**2.2.1. List of lecture topics**

№	Topic	Quantity of hours
<b>Part 1 Morphology and physiology of microorganisms. Infection. Immunity</b>		
1	Microbiology as a science. Connect with other medical disciplines. The morphology and physiology of bacteria. Chemical composition and metabolism in bacteria. The evolution and classification of microorganisms.	2
2	Microbial antagonism. The doctrine of chemotherapeutic drugs. Antibiotics. Genetics of bacteria and viruses. Fundamentals of biotechnology and genetic engineering.	2
3	Infection and infectious process.	2
4	The doctrine of immunity.	2
5	Microbiological bases of immunoprophylaxis and immunotherapy.	2
<b>Part 2 General and special virology</b>		
6	General characteristics of viruses. SARS viruses. Orthomyxoviruses. Human influenza viruses. Coronaviruses. Adenoviruses.	2

7	Picornaviruses. Polioviruses.	2
8	Hepatitis viruses.	2
9	Herpesviruses. Oncogenic viruses. Features of antitumor immunity.	2
10	Retroviruses. AIDS virus.	2
<b>Total (hours)</b>		<b>20</b>

### 2.2.2 List of seminar classes topics

Not provided by the program

### 2.2.3 List of practical classes topics

№	Topic	Quantity of hours	Teaching methods	Control methods
<b>Part 1 Morphology and physiology of microorganisms. Infection. Immunity</b>				
1	Rules of work in the bacteriological laboratory. Immersion microscope. Spherical-shaped bacteria..	2	Narrative-explanation, conversation, demonstration, presentation	Oral examination, test control
2	Rod-shaped Bacteria. Sophisticated methods of staining microorganisms. Gram stain.	2	Narrative-explanation, conversation, demonstration, presentation	Oral examination, test control
3	Vibrios. Spirochetes. Flagella in bacteria. Study of mobility.	2	Narrative-explanation, conversation, demonstration, presentation	Oral examination, test control
4	Spores, spore formation. Methods of staining spores. Capsules in bacteria and methods of their detection.	2	Narrative-explanation, conversation, demonstration, presentation	Oral examination, test control
5	Morphology of rickettsiae and chlamydia.	2	Narrative-explanation, conversation, demonstration, presentation	Oral examination, test control
6	Morphology of human viruses and bacteriophages.	2	Narrative-explanation, conversation, demonstration, presentation	Oral examination, test control
7	Bacterial nutrition. Simple nutrient media. Inoculation of meat-peptone agar and harvest broth. Sterilization methods.	2	Narrative-explanation, conversation, demonstration, presentation	Oral examination, test control
8	Isolation of pure aerobic cultures. Elective nutrient media.	2	Narrative-explanation, conversation, demonstration, presentation	Oral examination, test control

9	Study of colonies. Bacterial pigments.	2	Narrative- explanation, conversation, demonstration, presentation	Oral examination, test control
10	Identification of the selected pure culture. Bacterial enzymes. Differential-diagnostic nutrient media.	2	Narrative- explanation, conversation, demonstration, presentation	Oral examination, test control
11	Bacterial respiration. Isolation of pure cultures of anaerobes.	2	Narrative- explanation, conversation, demonstration, presentation	Oral examination, test control
12	Cultivation of viruses, rickettsiae and chlamydia.	2	Narrative- explanation, conversation, demonstration, presentation	Oral examination, test control
13	Conclusion № 1. Morphology and physiology of microorganisms.	2	Narrative- explanation, conversation, demonstration, presentation	Oral examination, test control
14	The study of infection. Infection of experimental animals	2	Narrative- explanation, conversation, demonstration, presentation	Oral examination, test control
15	The study of immunity. Serological tests. At. Pt. Lysis test. CFT.	2	Narrative- explanation, conversation, demonstration, presentation	Oral examination, test control
16	The study of immunity. At. Pt. Lysis test. CFT.	2	Narrative- explanation, conversation, demonstration, presentation	Oral examination, test control
17	The study of immunity. Labeled serological test. PCR.	2	Narrative- explanation, conversation, demonstration, presentation	Oral examination, test control
18	Immune sera. Neutralization reaction. Titration of antitoxic serum. Vaccines. The doctrine of phagocytosis.	2	Narrative- explanation, conversation, demonstration, presentation	Oral examination, test control
19	Antibiotics. Genetics of microorganisms.	2	Narrative- explanation,	Oral examination,



			conversation, demonstration, presentation	test control
20	Conclusion 2. Infection. Immunity. Antibiotics. Genetics.	2		Concluding test control, oral examination
<b>Part 2 General and special virology</b>				
21	The basic properties of viruses and laboratory diagnosis of virus infection. Laboratory Diagnosis of Influenza Virus Infection, COVID and Adenovirus Infection.	2	Narrative-explanation, conversation, demonstration, presentation	Oral examination, test control
22	Laboratory diagnosis of enterovirus infections.	2	Narrative-explanation, conversation, demonstration, presentation	Oral examination, test control
23	Laboratory diagnosis of rabies.	2	Narrative-explanation, conversation, demonstration, presentation	Oral examination, test control
24	Laboratory diagnosis of herpesvirus infections.	2	Narrative-explanation, conversation, demonstration, presentation	Oral examination, test control
25	Laboratory diagnosis of measles, rubella and mumps.	2	Narrative-explanation, conversation, demonstration, presentation	Oral examination, test control
26	Laboratory Diagnosis of Parainfluenza and Mumps	2	Narrative-explanation, conversation, demonstration, presentation	Oral examination, test control
27	Laboratory diagnosis of viral hepatitis	2	Narrative-explanation, conversation, demonstration, presentation	Oral examination, test control
28	Oncogenic viruses. Antitumour Immunity.	2	Narrative-explanation, conversation, demonstration, presentation	Oral examination, test control
29	Retroviruses. Human Immunodeficiency Viruses (HIV).	2	Narrative-explanation, conversation, demonstration,	Oral examination, test control

			presentation	
30	<b>Conclusion № 3. Generalandspecialvirology.</b>	2		Concluding test control, oral examination
<b>Total (hours)</b>		<b>60</b>		

#### 2.2.4 Laboratory classes

Not provided by the program

#### 2.2.5 Individual student's work

№	Topic	Quantity of hours	Control
1	Preparing for practical classes - theoretical training and development of practical skills	30	Current on practical classes
2	Independent elaboration of topics that are not included in the lesson plan:		Current on practical classes
	Stages of development of microbiology (preparation of the abstract).	1	Current on practical classes
	Individual work: To master the skills to prepare and paint drugs for the study of bacteria. Master the ability to sow pathogenic material and bacterial cultures on nutrient media.	1	Current on practical classes
	Genetics of viruses.	1	Current on practical classes
	Master practical skills: Determine antibiotic susceptibility of bacterial cultures.	1	Current on practical classes
	Factors of pathogenicity of microorganisms (abstract preparation).	1	Current on practical classes
	Immunopathology. Assessment of the immune status of the organism (preparation of the abstract).	2	Current on practical classes
	Individual independent work: to create a scheme of cellular cooperation in the immune response	1	Current on practical classes
	RNA genomic viruses. General characteristics.	2	Current on practical classes
	DNA genomic viruses. General characteristics.	2	Current on practical classes
4	Preparing for conclusions	3	Current on practical classes
<b>Total (hours)</b>		<b>55</b>	

## Evaluation system and requirements

**Types of control.** Assessment of students is carried out in accordance with the "Instructions for assessing the educational activities of students in the European credit transfer system for the organization of the educational process in the KhNMU."

The current educational activity of students is controlled by the teacher of the academic group. After the mastering each topic the teacher marks student using a 4-point (national) system. As a result of the semester the teacher automatically receives the average grade for the current educational activity with the help of the electronic register.

**Methods of control.** The current control includes following methods: individual and frontal questioning, blitz-questioning, solving situational tasks, tests, work in groups, written assignments, presentations of individual reports.

**Forms of control.** The final control is carried out at the last lesson, might include all forms of current control and provided by the study program of the discipline. According to the results of study activities, a credit of a two-point scale ("credit" - "non credit") is given.

The average grade for the current activity is converted to the multipoint scale for the courses which studying is finished with a credit.

### **Conversion of the average score for current activity into a multipoint scale**

The evaluation of the study activity is carried out according to general and professional competencies and converted into the multipoint scale.

### **Assessment of current learning activities**

When assessing the each topic of the discipline and the conclusion, the student is graded according to the traditional 4-point system: "excellent", "good", "satisfactory" or "unsatisfactory".

The final score for the current learning activity and the conclusion is defined as the arithmetic mean of the traditional grades for each class and conclusion, rounded to 2 decimal places and listed in a multi-point scale according to the standard table.

Table 1

### **Conversion of the mean arithmetic mark for the current learning activity to a multi-score scale (for subjects completed by dif. credit or final exam)**

4-point scale	120-points scale	4-point scale	120-points scale
5	120	3.91-3,94	94
4.95-4,99	119	3.87-3,9	93
4.91-4,94	118	3.83- 3,86	92
4.87-4,9	117	3.79- 3,82	91
4.83-4,86	116	3.74-3,78	90
4.79-4,82	115	3.7- 3,73	89
4.75-4,78	114	3.66- 3,69	88
4.7-4,74	113	3.62- 3,65	87
4.66-4,69	112	3.58-3,61	86
4.62-4,65	111	3.54- 3,57	85
4.58-4,61	110	3.49- 3,53	84
4.54-4,57	109	3.45-3,48	83
4.5-4,53	108	3.41-3,44	82
4.45-4,49	107	3.37-3,4	81
4.41-4,44	106	3.33- 3,36	80
4.37-4,4	105	3.29-3,32	79
4.33-4,36	104	3.25-3,28	78
4.29-4,32	103	3.21-3,24	77
4.25- 4,28	102	3.18-3,2	76
4.2- 4,24	101	3.15- 3,17	75
4.16- 4,19	100	3.13- 3,14	74
4.12- 4,15	99	3.1- 3,12	73
4.08- 4,11	98	3.07- 3,09	72
4.04- 4,07	97	3.04-3,06	71
3.99-4,03	96	3.0-3,03	70
3.95- 3,98	95	Less than 3	Not enough

### Assessment of the conclusion lesson

Conclusion is conducted in accordance with the curriculum of the discipline schedule, during classes.

To prepare the following materials are presented on department:

- test tasks;
- list of theoretical questions (including questions on independent work);
- list of practical skills;
- criteria for assessing the knowledge and skills of students;
- schedule of students work offs during the semester.

### Assessment of individual student tasks

At the meeting of the department should be approved a list of individual tasks (participation in reports at student conferences, profile competitions, preparation of analytical reviews with presentations) with the definition of the number of points for their implementation, which can be added as incentives (not more than 10).

Points for individual tasks are awarded to the student only once as a commission (commission - head of the department, vice-head, group teacher) only if they are successfully completed and defended. In no case may the total amount of points exceed 120 points.

### Assessment of individual students' work

Assimilation of topics that are submitted only for independent work is checked during the final lesson and exam.

### 3.2 Questions for conclusion:

- 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.
- 3 Origin and evolution of microorganisms. Modern classification of procaryotes. Bacterial taxonomy. Main taxons. Species as the main taxonomic unit.
- 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 eukariotic cells.
- 5 Chlamydiae. Classification. *C.psittaci*, *C.trachomatis*, *C.pneumoniae*. General properties. Life cycle. Cultivation of chlamydiae.
- 6 Morphology of Rickettsia. Methods of staining of Rickettsia.
- 7 Staining of bacteria. Dyes used in microbiology. Differential stains. Gram's stain. Principle. Procedure. Mechanisms: chemical and physical theories.
- 8 Metabolism of microorganisms. Bacterial nutrition. Classification of bacteria on the basis of nutritional requirements.
- 9 History of discovery of viruses. D.I.Ivanovsky as the founder of virology. Stages of development of virology. Morphology and viral ultrastructure. Types of symmetry. Chemical composition. Functions of viral subunits.
- 10 Sterilization, disinfection, and antiseptis. Methods of sterilization. Methods of disinfection. Classification of disinfectants. Chemical disinfectants.
- 11 Bacterial growth and multiplication. Phases of bacterial growth, starting with an inoculum of stationary phase cells.
- 12 Enzymes of microorganisms. Role of enzymes in metabolism, the conversion of energy and pathogenicity of bacteria.
- 13 Antibiotics. History of discovery. Role of A.Fleming. Classification. General criteria for effective antibiotic action. General principles of effective antibacterial therapy.
- 14 Normal microflora of the human body. Role of normal microflora in the physiological and pathological processes. Gnotobiology. Role of I.I. Metchnikoff in the development of study of normal microflora. Dysbacteriosis and causes of its origin.
- 15 The notion of chemotherapy and chemotherapeutic agents. Chemotherapeutic index. Mechanism of antibacterial action of Sulfonamides. Role of P.Erlich and T.Domagk in the development of study of chemotherapy.
- 16 Pure cultures of microorganisms, their significance for the theory and practice of microbiology. Principles of isolation and identification of pure cultures.
- 17 Extra chromosomal genetic elements of bacteria. Plasmids, their properties and classification. Transposable genetic elements:insertion sequences and transposons.
- 18 Viruses. Definition and properties. Classification. Morphology of viruses. Virion structure. Chemical properties. Functions of viral components.
- 19 Culture and isolation of viruses. Types of cell cultures: primary, diploid and heteroploid cultures. Detecting viral growth in cell cultures.
- 20 Bacterial metabolism and the conversion of energy Respiration of bacteria. Anaerobes. Methods of anaerobic culture. Anaerobic jar. GASPAC.
- 21 Clinical microbiology. Collection and transport of clinical specimens. Specimen containers and their transport. Handling of specimen in the laboratory. Selection of laboratory investigations.
- 22 Achievements in microbiology. Modern methods of detection of pathogen-specific macromolecules. Detection of nucleic acid sequences: nucleic acid probe tests, polymerase chain reaction.

- 23 Modern views on the nature and origin of viruses. Position of viruses in the system of the alive. Means of classification and naming of viruses. Families of DNA viruses. Families of RNA viruses. Some important members.
- 24 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.
- 25 Types of viral infection of a cell: abortive, lytic, and persistent infections. The stages of viral infection. The viral replication cycle: recognition of and attachment to the target cell, penetration, uncoating, macromolecular synthesis, assembly, release.
- 26 Enzymes of microorganisms, classification, their role in metabolism. Use for identification of bacteria. Enzymes of pathogenicity.
- 27 Host defenses against viral infection: natural barriers, nonspecific immune defenses, antigen-specific immune responses. Viral immunopathogenesis.
- 28 Viral detection: hemadsorption, hemagglutination. Hemagglutination inhibition test. Mechanism and technique. Interpretation of results.
- 29 Study of morphology of bacteria. Optical methods: oil immersion microscopy, phase contrast microscopy, dark ground microscopy. Staining of bacteria.
- 30 Capsule. Functions. Demonstration of capsule. Capsular stain. India ink method (after Burri-Gience).
- 31 Spirochetes. Taxonomy, classification, general properties, morphological structure. The most common pathogens.
- 32 Bacterial taxonomy. Modern principles of bacterial classification: division, class, order, family, tribe, genus, species. Nomenclature and main taxons. The species concept in bacteriology.
- 33 Chemical composition of bacterial cell. Essential elements, their sources, and functions in Prokaryotes. Nucleic acids, proteins, lipids, and carbohydrates, their biosynthesis and functions.
- 34 Bacterial metabolism. Nutritional requirements of bacteria. Culture media. The basic requirement to culture media. Classification of media.
- 35 Bacterial structure. Differences between prokaryotic and eukaryotic cells. Cell envelope, cytoplasmic components, external structures (capsules, flagella, and pili) of bacterial cell.
- 36 Dyes used for bacterial spore staining. Spore staining. Modified acid fast techniques (Gansen's method).
- 37 Cultivation of viruses. Animal inoculation indication of the viruses in inoculated animals.
- 38 Discovery of viruses. Main stages in the development of virology. Modern classification of viruses.
- 39 Achievements in microbiology. R.Koch as the founder of microbiology.
- 40 Acid fast bacteria. Ziehl Neelsen stain. Principle and technique.
- 41 Bacterial metabolism. Respiration of bacteria. Classification of bacteria according to type of respiration. Anaerobes. Anaerobic culture methods of isolating anaerobic pure cultures.
- 42 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.
- 43 Spores. Structure of spores. Function. Formation of spores. Types of bacterial spores. Spore stain.
- 44 The family Mycoplasmataceae. Classification. General characteristics. Morphological properties and culture. Staining of mycoplasma.
- 45 Protozoa. Classification. General characteristics. Morphological properties. Microscopic detection: blood samples, tissue samples, sputum samples. Specimen collection. Examination. The Romanovsky-Giemsa staining.
- 46 Cell envelope. Components. Cell wall. Structure in Gram-positive and Gram-negative bacteria. Functions. Differential stains. Gram's stain.
- 47 Flagella. Basal structure of bacterial flagellum. Types of flagellar arrangement. Fimbriae (pili). Functions. Demonstration. Dark ground (field) microscopy. Staining techniques.
- 48 Protoplasts, spheroplasts, L-forms of bacteria. Morphology, type of growth. Role in the human pathology.
- 49 Pneumocystis carinii. Morphology and taxonomic status. Life cycle. Staining by Giemsa method.

- 50 Basic concepts in immunity. Central and peripheral organs of the Immune System. Inductive and productive phases of immune response.
- 51 Basic concepts in Infection. Role of microorganisms in infectious process. Pathogenicity. Virulence. Factors predisposing to microbial pathogenicity. Doses and methods of their detection.
- 52 Immune System. Structure and functions. Cells of the Immune System. Classification. Characteristics. Cooperation of immunocompetent cells in immune response.
- 53 Live attenuated vaccines, principles of preparation, control. Practical use of live vaccines. Efficiency.
- 54 The study of infection. Dynamic of development of infectious diseases. Periods. Classification of infection: carriage, reinfection, superinfection, relapse (recurrence) infections.
- 55 Toxoides, their preparation, purification, units of measurement, use, efficiency.
- 56 Antibodies. Immunoglobulin types and structures. Antibody response: primary versus secondary (anamnestic) responses. Dynamic. Autoantibodies Monoclonal antibodies. Hybridomas.
- 57 Efficacy of antiparasitic immune responses.
- 58 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.
- 59 Hypersensitivity of delayed type (DTH). Mechanisms. Important characteristics of the types of DTH reactions. Skin allergic tests.
- 60 Immunity. Modern determination of the notion of "Immunity". Stages of the development of immunology. Types of immunity and forms of its manifestation.
- 61 Nonspecific defense mechanisms. Phagocytosis. Phagocytic cells. Steps of phagocytosis. Complete and incomplete phagocytosis.
- 62 Immunoglobulin classes, their structure and properties. Complete and incomplete antibodies. Immunoglobulin specificities.
- 63 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.
- 64 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.
- 65 Genetics of microorganisms. Organization of the genetic bacterial apparatus. Genotypical and phenotypical variation of microorganisms, its practical significance. Dissociation in bacteria.
- 66 Precipitation reaction. Mechanism of precipitation. Applications of precipitation reaction. Electroimmunodiffusion.
- 67 Reactions with "labelled" antibodies and antigens. Immunofluorescence: direct and indirect. The flow cytometer.
- 68 Serologic testing. General considerations. Clinical applications. Interpretation. Complement fixation tests. Technique, purpose, and clinical examples.
- 69 Serologic testing in virology. General considerations. Virus neutralization tests. Techniques. Practical guidelines.
- 70 Bacterial mutation. Origins. Types. Detection. Mutation repair mechanisms. Mutation suppression.
- 71 Types of vaccines. Classification. Recombinant vaccines. DNA vaccines.
- 72 Humoral immune response. Steps of the antibody production. Primary and secondary (anamnestic) responses. Immunological memory, its mechanism.
- 73 Immunology of malignancy. Tumour antigens. Immune response in malignancy. Immunotherapy of cancer.
- 74 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.
- 75 The notion of genotype, genotype, and phenotype. Types of variation in bacteria.

- 76 Antibiotic susceptibility testing. Minimal inhibitory concentration (MIC). Methods for MIC determination: tube dilution, Kirby-Bauer technique, B-lactamase tests.
- 77 Bacterial resistance to antibacterial agents: intrinsic and acquired resistance. Basic mechanisms of resistance to antibiotics. Mutation and transfer of resistance genes among bacteria.
- 78 Opportunistic microorganisms, biological properties, their role in human pathology. *Pseudomonas aeruginosa*, *Proteus* spp. as the causative agents of nosocomial infection. General properties. Determinants of pathogenicity. Pathogenesis and clinical disease. Epidemiology. Laboratory diagnosis. Treatment and prevention.
- 79 Agglutination reaction. Mechanism of agglutination. Passive agglutination tests. Applications of agglutination reaction.
- 80 Genetic engineering and biotechnology. Common enzymes used in molecular biology (restriction endonucleases, polymerases, reverse transcriptases, ligases). Cloning of foreign DNA in vectors.
- 81 Cultivation of viruses. Embryonated eggs. Structure. Technique of inoculation of specimens. Detecting viral growth in embryonated eggs.
- 82 Essence of antiviral immunity. Humoral immunity. Cell-mediated immunity. Pathologic consequences of the antiviral immune response. Evasion of the immune response.
- 83 Antigens. Complete antigens and haptens. Determinants of antigenicity. Antigenic structure of bacteria. Antigenic structure of viruses.
- 84 The phenomenon of antagonism in microbes. Antibiotics, their definition. Classification of antibiotics according to their points and mechanisms of action.
- 85 Enzyme-linked immunosorbent assay (ELISA). Radioimmunoassay (RIA). Western blot analysis. Mechanisms and applications of the reactions.
- 86 Infection. Definition. Classification of infection. Types of infectious diseases: endemic, epidemic, and pandemic diseases.
- 87 Vaccines. Classification. Immunization schedules. Killed (inactivated) vaccines. Vaccines as immunotherapeutic agents.
- 88 Infection. Sources of infection in man. Methods of transmission of infection: contact, inhalation, ingestion, inoculation, insects. Congenital, iatrogenic infections.
- 89 Characters of pathogens. Pathogenicity, virulence. Bacterial virulence factors: capsules, adhesions, exoenzymes, toxins, invasiveness. Dose. LD<sub>50</sub>. Study the virulence and toxigenicity of microorganisms.
- 90 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.
- 91 Toxigenicity of microorganisms. Bacterial toxins. Distinguishing features of exotoxins and endotoxins. Genetic basis of bacterial pathogenicity.
- 92 Laboratory diagnosis of viral infections. Culture and isolation. Serology. DNA hybridization.
- 93 Viral Genetics. Viral genomes. Viral mutation. Interaction between viruses. The role of genetic variation in the evolution of viruses.
- 94 Laboratory diagnosis of bacterial infections. Microscopic examination of patient specimens. Detection of pathogen-specific macromolecules. Culture and isolation of microorganisms. Serologic testing.
- 95 DNA transfer between bacteria. Conjugation. Transformation. Transduction.
- 96 Hypersensitivity. Classification of hypersensitivity reaction. Immediate hypersensitivity. Reagin (anaphylaxis), cytolytic and cytotoxic types of reactions. Immune complex disease (serum sickness). Mechanisms and mediators.
- 97 Immunodeficiency diseases. Primary immunodeficiencies. Classification of primary immunodeficiency syndromes. Secondary immunodeficiency.
- 98 Activators and stimulators of immune functions: cytokines, lymphokines, and chemokines. Sources, major targets, and functions.



- 99 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.
- 100 Adenoviruses. General characteristics: structure, serotypes. Epidemiology. Pathogenesis and clinical disease. Laboratory diagnosis. Treatment. Prevention.
- 101 Poxviruses. Classification. Structure. Smallpox, cowpox, and monkeypox. Epidemiology, clinical disease. Laboratory diagnosis. Prevention. Declaration of the World Health Organization: the world «smallpox-free».
- 102 Retroviruses. Human Immunodeficiency viruses (HIV). General characteristics. Acquired Immune Deficiency Syndrome (AIDS). Epidemiology. Pathogenesis. Clinical stages of HIV infection. Laboratory Diagnosis. Treatment. Immunoprophylaxis.
- 103 Picornaviruses. Classification. General characteristics. Biological properties. Antigens. Role in human's pathology. Coxsackieviruses. Echoviruses. Epidemiology. Pathogenesis and clinical disease. Laboratory diagnosis. Treatment. Prevention. Newer enteroviruses.
- 104 Rhabdoviruses. General properties. Rabies. Epidemiology. Pathogenesis and clinical disease. Treatment. Control and prevention.
- 105 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. Severe acute respiratory syndrome (SARS).
- 106 Polioviruses. Classification. General characteristics. Poliomyelitis. Epidemiology. Pathogenesis. Immunity. Clinical disease. Laboratory diagnosis. Prevention.
- 107 Hepatitis viruses. Classification. Hepatitis B virus. General properties. Associated antigens. Epidemiology. Pathogenesis and clinical disease. Laboratory diagnosis. Treatment. Prevention: passive and active immunization.
- 108 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). Arenaviruses (the Lassa fever virus). General properties. Epidemiology. Pathogenesis and clinical diseases. Laboratory diagnosis. Control and prevention.
- 109 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.
- 110 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.
- 111 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.
- 112 Circoviridae. Classification. Hepatitis TT and SEN. Epidemiology. Pathogenesis. Clinical syndroms. Laboratory diagnosis. Treatment. Prevention.
- 113 The family Picornaviridae. Cardioviruses. Epidemiology. Pathogenesis. Clinical syndroms. Laboratory diagnosis. Treatment. Prevention.
- 114 The family Picornaviridae, Rhinoviruses. Epidemiology, Clinical syndroms. Laboratory diagnosis. Treatment. Prevention.
- 115 Oncogenic viruses. General principles of viral oncogenesis. Proviruses and oncogenes. Mechanism of malignant transformation. DNA tumor viruses. RNA tumor viruses. Identifying viral oncogenic behavior.
- 116 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.

- 117 Hospital (nosocomial) infection. Microbiology of hospital infections. Common types of hospital infections. Diagnosis and control of hospital infection.
- 118 Probiotics and eubiotics. Characteristics. Mechanism of action.
- 119 Modern methods of laboratory diagnosis of infectious diseases.
- 120 Bacterial communication and group behavior. Biofilms. Quorum sensing.
- 121 Clinical microbiology: specimen collection, transport, and processing. Identification of pathogens. Antibiotic sensitivity testing.
- 122 Bacteriology of water. Bacterial flora in water. Factors determining the kinds and number of bacteria in water. Coli-titre. Coli-index. Bacteriological examination. Virological examination. Examination for specific pathogens.
- 123 Bacteriology of milk. Type of bacteria in milk. Milk borne diseases. Bacteriological examination.
- 124 Bacteriology of air. Measurement of air contamination. Bacteriological examination of environmental dust.
- 125 Bacteriology of soil. . Type of bacteria in soil. Soil borne diseases. Bacteriological examination.

#### 4. POLICY AND VALUES OF THE DISCIPLINE

In order to successfully complete the relevant course, it is necessary to regularly attend practical classes; to have theoretical preparation for practical classes according to the subject; not to be late and not to miss classes; perform all necessary tasks and work in each lesson; be able to work with a partner or in a group; contact the curators of the course on various issues on the subject of classes and receive it when you need it.

Students have the right to discuss various tasks, but their performance is strictly individual. It is not allowed to write off, use various software tools, tips, use electronic gadgets during classes for purposes other than the educational process. Students are not allowed to be late for practical classes.

Students are encouraged to participate in research and conferences on this topic.

Students with special questions can meet with the teacher or warn him before the start of classes, at the request of the student it can be done by the group leader. If you have any questions, please contact the teacher.

KhNMU provides training and work that is free from discrimination, sexual harassment, intimidation or exploitation. All students of KhNMU are protected by the *"Regulations on the Prevention, Prevention and Settlement of Cases Related to Sexual Harassment and Discrimination at Kharkiv National Medical University"*, which is designed to define an effective mechanism for resolving conflict situations related to discrimination and sexual abuse.

The regulation is developed on the basis of the following normative legal acts of Ukraine: the Constitution of Ukraine; Law of Ukraine "On Education"; Law of Ukraine "On Higher Education"; Law of Ukraine "On Principles of Prevention and Counteraction of Discrimination in Ukraine"; Law of Ukraine "On Ensuring Equal Rights and Opportunities for Women and Men"; Convention for the Protection of Human Rights and Fundamental Freedoms; Convention for the Suppression of Discrimination in Education; Convention on the Elimination of All Forms of Discrimination against Women; General recommendation № 25 to paragraph 1 of Article 4 of the Convention on the Elimination of All Forms of Discrimination against Women; General Comment № 16 (2005) "Equal rights for men and women to enjoy economic, social and cultural rights" (Article 3 of the International Covenant on Economic, Social and Cultural Rights; UN Economic, Social and Cultural Rights Committee); Recommendations on education in the spirit of international understanding, cooperation and peace and education in the spirit of respect for human rights and fundamental freedoms (UNESCO); The concept of the State Social Program to ensure equal rights and opportunities for women and men for the period up to 2021.

The University recognizes the importance of confidentiality. All persons responsible for the implementation of this policy (employees of deans' offices, faculties, institutes and the Center for Gender Education, members of the student government and ethics committee, vice-rector for

scientific and pedagogical work) are confidential about persons who reported or accused of discrimination or sexual harassment (except when the law requires disclosure and / or when disclosure by the University is necessary to protect the safety of others).

KhNMU creates a space of equal opportunities, free from discrimination of any national, racial or ethnic origin, sex, age, disability, religion, sexual orientation, gender, or marital status. All rights, privileges, programs and activities granted to students or staff of the University apply to all without exception, provided they are properly qualified. The anti-discrimination policy and the policy of counteracting sexual harassment of KhNMU are confirmed by the Code of Corporate Ethics and the Charter of KhNMU.

It is important for students to follow the rules of good behavior at the university. These rules are common to all, they also apply to all faculty and staff, and do not differ in principle from generally accepted norms.

### **Behavior in classes**

It is important for students to follow the rules of good behavior at the university. These rules are common to all, they also apply to all faculty and staff, and are not fundamentally different from the generally accepted norms.

During classes it is allowed:

leave the audience for a short time if necessary and with the permission of the teacher;

drink soft drinks;

take photos of presentation slides;

take an active part in the class.

Forbidden:

eat;

smoking, drinking alcohol and even low-alcohol beverages or drugs;

to use obscene language or use words that offend the honor and dignity of colleagues and faculty;

gaff;

to damage the material and technical base of the university (damage inventory, equipment; furniture, walls, floors, litter the premises and territories);

shouting, shouting or listening to loud music in classrooms and even in corridors during classes.

*Plagiarism and academic integrity.* D.P. Grynyov Department of Microbiology, Virology and Immunology maintains zero tolerance for plagiarism. Students are expected to constantly raise their awareness of academic writing. On first lessons it will be provided information on what to consider plagiarism and how to properly conduct research and scientific research.

*Occupational Health.* The first lesson of the course will explain the basic principles of labor protection by conducting appropriate training. It is expected that every higher education seeker should know where the evacuation exit closest to the audience is, where the fire extinguisher is, how to use it, and so on.

The procedure for informing about changes in the syllabus: the necessary changes in the syllabus are approved by the methodical commission of KhNMU on problems of general and pre-professional training and published on the site of KhNMU, the site of the D.P. Grynyov Department of Microbiology, Virology and Immunology.

### **Using of electronic gadgets**

Using of electronic gadgets during studying is allowed without restriction except those cases when it may interfere with the ways of objective assessment of students' knowledge.

### **Policy for people with the special educational needs**

The studying is carried out taking into account the requirements of modern Ukrainian

legislation in relation to persons with special educational needs and is regulated by the university.

### **Recommendations for successful mastering the discipline**

In the process of preparation for practical classes students should study the recommended literature. Active participation during the discussion in the classroom is welcome, students should be ready to understand the material in detail, ask questions, express their point of view, discuss.

### **Incentives and penalties**

According to the "Instructions for the evaluation of educational activities in the European credit-transfer system of the educational process in the KhNMU" students can increase the grade for the module by performing individual tasks (making the reports, participation in scientific conferences, competitions, preparation of reviews, etc.) in case of success gives 10 points as an incentive.

### **Safety precautions**

The first lesson includes an explanation of the basic principles of labour protection. Every student should know the location of nearest evacuation exit, the fire extinguisher, how to use it, etc.

### **Procedure for informing about changes in the syllabus**

The possible changes in the syllabus will be announced on the department page of the of the official website of KhNMU, in the department's directory in Moodle, and at the dean-office

### **5.POLITICS OF ACADEMIC INTEGRITY**

The plagiarism is unaccepted in the Kharkiv National Medical University. In turn the students are expected to master the recommended literature and original sources during preparation of assignments doing the references. The students are explained how to correctly cite the sources in the text, make references and describe them, how to search information.

### **6. RECOMMENDED LITERATURE**

#### **Recommended books:**

1. Jawetz, Melnick, & Adelberg's Medical Microbiology, 26th Edition, 2012, English. – 880 p. – ISBN-13: 978-0071790314
2. Murray PR. Human microbiota. In: Borriello SP, Murray PR, Funke G, eds. Topley and Wilson's Microbiology and Microbial Infections: Bacteriology. 10<sup>th</sup> edition. London: HodderArnold, 2014.
3. Murray PR. Medical microbiology / Patrick R.Murray, Ken S. Rosenthal, Michael A. Pfaller; consultant, JMI Laboratories. - 8<sup>th</sup> edition. Philadelphia: Elsevier Inc, 2016.
4. World Health Organization Guidelines [www.who.int](http://www.who.int)
5. Center Disease Control And Prevention Instructions <https://www.cdc.gov/>

Head of the DP Gynyov department of microbiology, virology and immunology, professor

M.M Mishyna