Federal State Autonomous Educational Institution of Higher Education
Peoples' Friendship University of Russia named after Patrice Lumumba

Institute of Medicine

educational division (faculty/institute/academy) as higher education programme developer

WORKING PROGRAM OF THE DISCIPLINE

MICROBIOLOGY, VIROLOGY

course title

Recommended by the Didactic Council for the Education Field of:

31.05.01. General Medicine

field of studies / speciality code and title

The course instruction is implemented within the professional education programme of higher education:

General Medicine

higher education programme profile/specialization title

2026

1. COURSE GOAL(s)

Discipline "Microbiology, Virology" is included in the curriculum of the specialist program "General Medicine" (field of study 31.05.01 "General Medicine") and is studied in the 4th and 5th semesters of the 2nd and 3rd years. The discipline is delivered by the V.S. Kiktenko Department of Microbiology.

The discipline consists of 8 sections and 32 topics and is aimed at studying the taxonomy, ecology, and biology of pathogens of human infectious diseases, as well as the general principles of human-microorganism interactions.

The goal of mastering the course is for students to acquire knowledge about pathogenic and opportunistic microorganisms for humans, their systematics, biological characteristics, ecology, methods of microbiological diagnostics, specific prophylaxis, and etiotropic treatment of the infectious diseases they cause.

2. REQUIREMENTS FOR LEARNING OUTCOMES

Mastering the discipline "Microbiology, Virology" is aimed at developing the following competencies (parts of competencies) in students: GPC-5, PC-2

Table 2.1. List of competences that students acquire through the course study

Competence code	**Competence descriptor**	**Competence formation indicators** (within this course)
GPC-5	Able to assess morphofunctional, physiological states and pathological processes in the human body to solve professional tasks	GPC-5.1 Masters the algorithm of clinical-laboratory and functional diagnostics when solving professional tasks; GPC-5.2 Able to evaluate the results of clinical-laboratory and functional diagnostics when solving professional tasks, including using artificial intelligence technologies; GPC-5.3 Able to determine morphofunctional, physiological states and pathological processes in the human body based on knowledge of the structure of the human body, the functioning of organs and systems in health and disease;
PC-2	Able to conduct patient examination for the purpose of establishing a diagnosis	PC-2.3 Able to refer a patient for laboratory examination when there are medical indications in accordance with current procedures for providing medical care, clinical recommendations (treatment protocols) on issues of medical care, taking into account medical care standards;

3. COURSE IN HIGHER EDUCATION PROGRAMME STRUCTURE

The course refers to the core/variable/elective* component of B block of the higher educational programme curriculum.

* - Underline whatever applicable.

Within the higher education programme students also master other (modules) and / or

internships that contribute to the achievement of the expected learning outcomes as results of the course study.

Table 3.1. The list of the higher education programme components/disciplines that contribute to the achievement of the expected learning outcomes as the course study results

Competence code	Competence descriptor	Previous courses/modules*	Subsequent courses/modules*
GPC-5	Able to assess morphofunctional, physiological states and pathological processes in the human body to solve professional tasks	Biochemistry Normal Physiology Biology Chemistry Bioorganic Chemistry Anatomy Histology, Embryology, Cytology	General Surgery, Obstetrics and Gynecology, Oncology and Radiation Therapy, Pathophysiology and Clinical Pathophysiology, Molecular Genetic Methods, Methods of Microbiological Diagnostics, Propedeutics of Internal Diseases, Pathological Anatomy and Clinical Pathological Anatomy, Radiation Diagnostics, Medical Elementology, Phthisiology, Anesthesiology, Resuscitation and Intensive Care, Ophthalmology, Methods of Cell Biology and Histology, Pharmacology, Topographic Anatomy and Operative Surgery, Forensic Medicine, Maxillofacial Surgery, Medical Forensics, Otorhinolaryngology, Pediatrics, Autopsy Course

PC-2	Able to conduct patient examination for the purpose of establishing a diagnosis	Molecular Genetics in Practical Biology and Medicine	Surgical Practice: Surgical Physician Assistant, General Medical Practice: General Practitioner Assistant, Outpatient Polyclinic Physician Assistant, Obstetric and Gynecological Practice: Obstetrician Assistant, Obstetric and Gynecological Practice: Gynecologist Assistant, General Medical Practice: Pediatrician Assistant, General Surgery, Dermatovenereology, Neurology, Medical genetics, neurosurgery, ophthalmology, faculty surgery, occupational diseases, hospital therapy, endocrinology, polyclinic therapy, hospital surgery, pediatric surgery, pediatrics, obstetrics and gynecology, anesthesiology, resuscitation, intensive care, oncology, radiation therapy, otorhinolaryngology, reproductive health, traumatology, orthopedics, faculty therapy, maxillofacial surgery, general medical skills, emergency conditions, propedeutics of internal diseases, urology, infectious diseases, psychiatry, medical psychology, allergology, phthisiology, endoscopic urology, telemedicine, clinical dentistry, topical issues of neonatology, cardiology in quests, medical enzymology,

			molecular genetic methods, methods of microbiological diagnostics, evidence-based medicine, autopsy course, radiation diagnostics, pathophysiology, clinical pathophysiology, pathological anatomy, clinical pathological anatomy, medical elementology, private radiology, outpatient pulmonology.

4. COURSE WORKLOAD AND ACADEMIC ACTIVITIES

The total workload of the course «**Microbiology, virology** » is **7** credits (252 academic hours).

Table 4.1. Types of academic work by periods of mastering the educational program of higher education for full-time study

Type of academic activities		**Total academic hours**	**Semesters/training modules**	
			4	**5**
Classroom learning *, ac.h.*		**180**	**90**	**90**
Lectures (LC)		**36**	**18**	**18**
Lab work (LW)		**0**	**0**	**0**
Seminars (workshops/tutorials) (S)		144	72	72
Self-studies		*54*	*18*	*36*
Evaluation and assessment (exam/passing/failing grade)		*18*	*0*	*18*
Course workload	ac.h.	**252**	**108**	**144**
	credits	**7**	**3**	**4**

5. THE DISCIPLINE CONTENT

Table 5.1. Content of the discipline (module) by types of academic work

Number of section Name of the discipline section	**Name of the topic Content of the topic**	**Type of academic work***
Section 1 **General Microbiology**	1.1 Systematics, morphology, and structure of microorganisms. Concept of systematics and classification of microorganisms. Taxonomic categories. Principles of the modern Bergey's classification of bacteria. Prokaryotes and eukaryotes. Main forms and polymorphism of bacteria. Structure of the bacterial cell.	LC,S

		Features of the morphology and structure of spirochetes, actinomycetes, mycoplasmas, rickettsiae, chlamydiae. Simple and complex methods of microbial staining. Methods of microscopy	
	1.2 Physiology of Microorganisms Chemical composition of the bacterial cell. Enzymes of microorganisms, their classification. Nutrition of microorganisms. Nature and types of biological oxidation of substrates by microorganisms. Classification of microbes by type of respiration. Growth and reproduction of microorganisms. Culture media for cultivating microorganisms and requirements for them, classification of culture media. Characteristics of cultivating strict anaerobes. Concept of cultural, enzymatic, and other properties of microbes.		LC,S
	1.3 Genetics of Microorganisms Organization of genetic material in bacteria: chromosome, mobile genetic elements (IS elements, transposons, integrons). Their structure, mechanisms of movement, and role in the formation of antibiotic resistance. Bacterial plasmids: structure, replication, classification (by function). R plasmids as a key factor in antibiotic resistance. Mechanism of conjugation. Horizontal gene transfer: transformation (Frederick Griffith's experiments), transduction (Joshua Lederberg's experiments), conjugation (Joshua Lederberg and Edward Tatum's experiments). Bacterial variability: phenotypic (modificational) and genotypic (mutations, horizontal transfer). The role of variability in immune evasion and the development of drug resistance. Regulation of gene expression in bacteria (operon concept): structure and mechanism of regulation of the lac operon in E. coli.		LC
	1.4 Influence of Environmental Factors on Microorganisms Influence of physical factors. Concept of sterilization and asepsis. Action of chemical substances. Concept of disinfection and antisepsis. Action of biological factors on microorganisms. Colicins. Antibiotics. Producers of antibiotics, principles of their production. Mechanism and spectrum of action of antibiotics. Antibiotic resistance of microbes.		LC,S
	1.5 Interactions of Normal human microbiota and its		LC

		microbial populations in the body. functions. The gut microbiota-brain axis (microorganisms, their functions). The gut microbiota-immune system axis (microorganisms, their functions). Dysbiosis, its causes and methods of correction. Pro- and prebiotics.	
Section 2 **General Virology**		2.1 Structure and chemical composition of viruses. Nature and origin of viruses. Forms of existence of viruses in nature. Principles of virion organization. Shape and size of virions. Types of symmetry and their determinants. Types of viral genomes. Structural proteins. Ability of virions to self-assemble. Lipids and carbohydrates of virions, their origin and significance.	LC,S
		2.2 Reproduction of viruses Forms of interaction of viruses with cells: productive, integrative, and latent infection. Virus reproduction and the scheme of main processes ensuring the realization of genetic information.	LC,S
		2.3 Cultivation of viruses Cultivation of viruses in naturally susceptible and laboratory animals, in chicken embryos, and in cell culture. The use of these biological systems in the laboratory diagnosis of viral diseases.	LC,S
		2.4 Bacteriophages Interaction of the phage with the bacterial cell. Temperate and virulent bacteriophages. Lysogeny. Phage conversion. Practical application of bacteriophages for prevention, treatment, and phage typing.	LC,S

Section 3 **Fundamentals of infection and immunity**	3.1 Fundamentals of infection Definition of infection, infectious process, infectious disease. Conditions for the occurrence of the infectious process. Pathogenicity and virulence of microbes. Quantitative determination of virulence. Parasitic microbes and saprophytes. Pathogenic and opportunistic microorganisms. Factors of pathogenicity. Characteristics of pathogenic microbes (invasiveness, specificity, virulence, toxicity, etc.). Microbial toxins (exo- and endotoxins). Properties and chemical composition. The role of microorganisms in the infectious process (susceptibility, infectious dose, portal of entry of infection, organotropism). Dynamics of the development of the infectious process, stages. Carriage of pathogenic microorganisms. Forms of manifestation of infection. Concept of relapse, reinfection, superinfection.	S
	3.2 Fundamentals of immunity. Serological method of diagnosis of infectious diseases. Definition of immunity. Forms and types of immunity. Species-specific and individual immunity. Complement system. Functions and activation pathways of complement components. Immunoglobulins. Structure. Classes and types of immunoglobulins. Role in the formation of immune responses. Factors of nonspecific resistance of the organism. Phagocytic theory of immunity. Antigens: definition, main properties. Antigens of the bacterial cell. Antibody formation: primary and secondary immune response. Affinity and avidity of antibodies. Hypersensitivity, types. Mechanisms of occurrence, clinical significance. Serological reactions. Bacterial preparations.	LC,S
	4.1 Pathogenic and resident cocci. Staphylococci, streptococci, neisseriae. Taxonomy, morphology, tinctorial and cultural properties, antigenic structure, pathogenicity factors, pathogenesis, epidemiology, immunity, prevention, treatment. Laboratory diagnosis of coccal infections.	LC,S

Section 4 **Medical Bacteriology**	4.2 Pathogens of airborne infections. Causative agent of diphtheria. Causative agents of pertussis and paraphussis. Pathogenic mycobacteria. Causative agents of tuberculosis and leprosy. Taxonomy, morphology, tinctorial and cultural properties, antigenic structure, pathogenicity factors, pathogenesis, epidemiology, immunity, prevention, treatment. Laboratory diagnosis of airborne infections.	LC,S
	4.3 Pathogenic and resident anaerobic bacteria. Causative agents of gas gangrene, tetanus, and botulism. Taxonomy, morphology, tinctorial and cultural properties, antigenic structure, pathogenicity factors, pathogenesis, epidemiology, immunity, prevention, treatment. Laboratory diagnosis of anaerobic infections.	LC,S
	4.4 Pathogens of zoonotic infections Causative agents of plague, tularemia, anthrax, and brucellosis. Taxonomy, morphology, tinctorial and cultural properties, antigenic structure, pathogenicity factors, pathogenesis, epidemiology, immunity, prevention, treatment. Laboratory diagnosis of zoonotic infections.	LC,S
	4.5 Pathogens of intestinal Causative agents of typhoid fever, salmonellosis, dysentery, cholera,	LC,S
	infections escherichiosis. Campylobacter and Helicobacter. Taxonomy, morphology, tinctorial and cultural properties, antigenic structure, pathogenicity factors, pathogenesis, epidemiology, immunity, prevention, treatment. Laboratory diagnosis of intestinal infections.	
	4.6 Pathogenic spirochetes Causative agent of syphilis. Borreliae and borrelioses. Causative agents of leptospirosis. Taxonomy, morphology, tinctorial and cultural properties, antigenic structure, pathogenicity factors, pathogenesis, epidemiology, immunity, prevention, treatment, laboratory diagnosis.	LC,S
	4.7 Pathogenic rickettsiae and chlamydiae. Causative agents of epidemic typhus, Q fever, and other rickettsioses. Causative agents of chlamydial infections. Taxonomy, morphology, tinctorial and cultural properties, antigenic structure, pathogenicity factors, pathogenesis, epidemiology, immunity, prevention, treatment, laboratory diagnosis.	LC,S

Section 5 **Protozoal infections**	5.1 Sarcodina Causative agent of amebic dysentery. Balantidiasis. Characteristics of the pathogens. Life cycle. Pathogenesis. Epidemiology. Methods of laboratory diagnosis.	LC
	5.2 Pathogens of trypanosomiasis and leishmaniasis Causative agents of American and African trypanosomiasis. Causative agents of cutaneous, mucocutaneous, and visceral leishmaniasis. Taxonomy. Characteristics of the pathogens. Life cycles. Pathogenesis of infection, microbiological diagnosis. Specific prophylaxis.	LC
	5.3 Sporozoa Causative agents of malaria. Morphology of the pathogens. Life cycle of the malaria plasmodium in the human body and in the mosquito. Clinical forms of the disease. Microbiological diagnosis. Chemotherapy. Malaria control measures. Toxoplasmosis. Characteristics of the pathogen, features of cultivation, routes of infection, and pathogenesis. Diagnostic methods. Specific therapy and prevention.	LC
Section 6 **Pathogenic fungi**	6.1 Morphology and biology of fungi Morphology and ultrastructure of fungi. Systematics of fungi. Cultural properties.	LC,S
	6.2 Mycoses Causative agents of dermatomycoses (microsporosis, trichophytosis, favus), subcutaneous and visceral mycoses. Laboratory diagnosis of fungal infections.	LC,S
Section 7 **Medical**	7.1 Poxviruses Causative agent of smallpox. Taxonomy. Characteristics of the viruses. Microbiological diagnosis, specific prophylaxis.	LC,S
	7.2 Viruses causing acute respiratory diseases Causative agents of influenza and measles. Coronaviruses. Taxonomy, characteristics of the pathogens. Pathogenesis of infections, microbiological diagnosis. Specific therapeutic and prophylactic preparations.	LC,S
	7.3 Viral hepatitis Causative agents of enteric and parenteral hepatitis. Taxonomy. Characteristics of the pathogens. Laboratory diagnosis. Prevention.	LC,S
	7.4 Herpesvirus infections Herpes simplex virus, varicella-zoster virus, cytomegaloviruses, Epstein-Barr virus. Taxonomy and characteristics of the pathogens. Laboratory diagnosis. Methods of prevention	LC,S

	7.5 Enteroviruses Causative agent of poliomyelitis. Taxonomy. Characteristics of the pathogen. Microbiological diagnosis. Specific prophylaxis.	LC,S
	7.6 Rhabdoviruses Causative agent of rabies. Taxonomy. Characteristics of the pathogen. Microbiological diagnosis, specific prophylaxis.	LC,S
	7.7 Retroviruses Human immunodeficiency viruses. Taxonomy. Characteristics of the pathogens. Mechanism of HIV interaction with the cell. Epidemiology. Features of pathogenesis and clinical presentation.	LC,S
Section 8 **Sanitary Microbiology**	8.1 Sanitary- bacteriological examination of air. Determination of the total microbial count and sanitary-indicator microorganisms in air. Assessment of the level of total microbial contamination using the cultural method, followed by quantitative analysis of isolated colonies on the surface of an agar nutrient medium, performed using artificial intelligence: the software "ColonyCount" (version 1.0.0) in accordance with the protocol for standardized counting of colony-forming units (CFU/ml).	S
	8.2 Sanitary- bacteriological examination of water Determination of the total microbial count and sanitary-indicator microorganisms in water. Assessment of the level of total microbial contamination using the cultural method, followed by quantitative analysis of isolated colonies on the surface of an agar nutrient medium, performed using artificial intelligence: the software "ColonyCount" (version 1.0.0) in	S
	accordance with the protocol for standardized counting of colony-forming units (CFU/ml).	

* - to be filled in only for **full** -time training: *LC - lectures; LW - lab work; S - seminars.*

6. CLASSROOM EQUIPMENT AND TECHNOLOGY SUPPORT REQUIREMENT

Table 6.1. Classroom equipment and technology support requirements

Type of academic activities	**Classroom equipment**	**Specialised educational / laboratory equipment, software, and materials for course study** (if necessary)

Lecture	Classroom for conducting lecture-type classes, equipped with a set of specialized furniture; a board (screen) and technical means for multimedia presentations.	Technical means: multimedia projector TOSHIBA X200, laptop ASUS F9E Core 2 DUO T5750, internet access available. Software: Microsoft products (OS, office application suite, including MS Office/Office 365, Teams, Skype).
Lab-work	Classroom for conducting laboratory work, individual consultations, ongoing assessment and intermediate certification, equipped with a set of specialized furniture and equipment.	The laboratory is equipped with specialized laboratory furniture; gas burners, chalkboard; technical means: electric screen Baronet 3.4 244/96 8 152*203MW, multimedia projector Epson EB-X05, laptop HP 6715s TL-60, microscopes "Biomed-5" and "BioOptic", laboratory dry-air incubator TSvL-160, refrigerator Indesit SD 167. Items necessary for microbiological studies: instruments (bacteriological loops and forceps), laboratory glassware, set of stains, culture media, microbial cultures.
Seminar	Classroom for conducting seminar-type classes, group and individual consultations, ongoing assessment and intermediate certification, equipped with a set of specialized furniture and technical means for multimedia presentations.	

Self-studies	Classroom for independent work of students (may be used for seminar classes and consultations), equipped with a set of specialized furniture and computers with access to the Electronic Information and Educational Environment (EIEE).	The laboratory is equipped with specialized laboratory furniture; a chalkboard; microscopes "Biomed-5" and "BioOptic".

7. RESOURCES RECOMMENDED FOR COURSE STUDY

Main readings:

1. Anil K. Sharma, Girish Kumar Gupta, Mukesh Yadav. Medical Microbiology. DE GRUYTER – 2022 - 273 c. - ISBN 9783110517644.
2. V.V. Zverev, M.N. Boichenko ; Zverev V.V., Boichenko M.N. Medical Microbiology, Virology, Immunology : textbook. Vol. 1 : учебник . - Москва : ГЭОТАР-Медиа, 2022. - 384 с. - ISBN 978-5-9704-7072-5.
3. V.V. Zverev, M.N. Boichenko ; Zverev V.V., Boichenko M.N. Medical Microbiology, Virology, Immunology : textbook : Vol. 2. : учебник - Москва : ГЭОТАР-Медиа, 2020. - 392 с. - ISBN 978-5-9704-5719-1.
4. Fields Virology. Volume 1. Emerging Viruses / Edited by Sean P.J. Whelan, Peter M. Howley, and David M. Knipe. - Электронные текстовые данные. - Wolters Kluwer Health, 2020. - 2795 c. - ISBN 9781975112547.

Additional readings:

Electronic full-text materials:

1. Willey J., Sandman K., Wood D. Prescott's Microbiology (12th Edition): USA, McGraw Hill; 12th edition (2023) - 1024 p.; ISBN- 1264088396.
2. John W. Foster, Zarrintaj Aliabadi, Joan L. Slonczewski. Microbiology: The Human Experience Second Edition (July 1, 2021). USA, W. W. Norton & Company; 1072 p.; ISBN- 0393533247
3. Warren Levinson. Review of Medical Microbiology and immunology (11 edition) USA, 2010, 1184 pp, ISBN978-5-9963-2913-7
4. Mietzner, Timothy A; Carroll, Karen C; Hobden, Jeffery A; Miller, Steve; Morse, Stephen A; Mitchell, Thomas G; Sakanari, Judy A; McKerrow, J. H. (James Hobson), Jawetz, Melnick & Adelberg's medical microbiology. (2016) New York : McGraw-Hill Education. ISBN- 9780071824989

***Printed publications*:**

1. Levinson U. Medical microbiology and immunology. Translated from English. Edited by V.B. Beloborodov. – 3rd ed. M.: Laboratory of Knowledge, 2020. – 1181 p.

Internet (based) sources

- 1. Electronic libraries with access for RUDN students:

-Electronic library network of RUDN – ELN RUDN

http://lib.rudn.ru/MegaPro/Web
- ELN «University Library online» http://www.biblioclub.ru
- ELN Urait http://www.biblio-online.ru
- ELN «Student Advisor» www.studentlibrary.ru
- ELN «Lan» http://e.lanbook.com/

- 2. Databases and search engines:
  - electronic fund of legal and regulatory and technical documentation http://docs.cntd.ru/
  - search system Yandex https://www.yandex.ru/
  - search system Google https://www.google.ru/
  - abstract database SCOPUS http://www.elsevierscience.ru/products/scopus/

Learning toolkits for self-studies during the development of the discipline

1. Lectures Synopsis on the discipline «Microbiology, virology».
2. Methodological guidelines for the implementation and execution of control and independent work on the discipline «Microbiology, virology ».

* - All educational and methodological materials for independent work of students are posted in accordance with the current procedure on the discipline page in the TUIS (Electronic Information and Educational Environment).

DEVELOPERS:

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position, educational department	signature	name and surname

HEAD OF THE DEPARTMENT:

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HEAD OF THE PROGRAMME:

Head of the General Medical Practice Department Department, Deputy Director of Instute of Medicine		N.V. Sturov
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