**Federal State Autonomous Educational Institution of Higher Education**
**PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA**
**RUDN University**

**Agrarian and Technological Institute**
educational division (faculty/institute/academy) as higher education programme developer

# COURSE SYLLABUS

Veterinary Microbiology and Mycology
course title

**Recommended by the Didactic Council for the Education Field of:**

36.05.01 Veterinary
field of studies / speciality code and title

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

Veterinary
higher education programme profile/specialisation title

**2024**

## 1. GOALS AND OBJECTIVES OF THE COURSE

The aim of mastering the course "**Veterinary microbiology and mycology**" is is to assist students in the development of theoretical questions about the diversity of the world of microorganisms, about their role in general biological processes and in animal pathology, the theoretical foundations of the diagnosis of infectious diseases, the principles of immunological research, the manufacture and control of biological products.

## 2. REQUIREMENTS FOR LEARNING OUTCOMES

The implementation of the course "**Veterinary microbiology and mycology**" is aimed at creating the following competencies (parts of competencies) for students:

*Table 2.1. List of competencies formed by students during the development of the course (results of the development of the course)*

| **Competence code** | **Competence descriptor** | **Indicators of competence accomplishment** (within the course**)** |
|---|---|---|
| GC-8 | Is able to create and maintain safe living conditions in everyday life and professional activities to preserve the natural environment, ensure the sustainable development of society, including the threat and emergence of emergencies and military conflicts | GC-8.1 Analyzes factors of harmful influence on the life activity of elements of the environment (technical means, technological processes, materials, buildings and constructions, natural and social phenomena); |
| | | GC-8.2 Identifies hazardous and harmful factors within the scope of the job; |
| | | GC-8.3 Identifies and corrects problems related to safety violations in the workplace; |

## 3. COURSE IN HIGHER EDUCATION PROGRAMME STRUCTURE

The course "**Veterinary microbiology and mycology**" refers to the mandatory part of block B1 of the Educational Program of Higher Education.

As part of the Educational Program of Higher Education, students also master other courses and /or practices that contribute to achieving the planned results of mastering the course "**Veterinary microbiology and mycology**".

*Table 3.1. List of Higher Education Program components courses that contribute to expected learning outcomes*

| **Competence code** | **Competence descriptor** | **Previous courses/modules, internships*** | **Subsequent courses/modules, internships*** |
|---|---|---|---|
| GC-8 | Is able to create and maintain safe living conditions in everyday life and professional | Basics of Professional Ethics<br>Inorganic and analytical chemistry | Virology and biotechnology<br>Veterinary radiobiology |

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| | activities to preserve the natural environment, ensure the sustainable development of society, including the threat and emergence of emergencies and military conflicts | Organic chemistry<br>Biological physics<br>Life safety | General and Veterinary Ecology<br>Study practice<br>Preparation for and passing the state exam |

## 4. COURSE WORKLOAD AND TRAINING ACTIVITIES

Course workload of the course "**Veterinary microbiology and mycology**" is 6 credits.

*Table 4.1. Types of academic activities during the period of the HE program mastering for **full-time** study*

| **Types of academic activities** | | **HOURS** | **Semesters** | | | |
|---|---|---|---|---|---|---|
| | | | **3** | **4** | **-** | **-** |
| Contact academic hours | | 122 | 68 | 51 | - | - |
| including | | | | | | |
| Lectures | | 34 | 17 | 17 | - | - |
| Lab work | | 85 | 51 | 34 | - | - |
| Seminars (workshops/tutorials) | | - | - | - | - | - |
| Self-study | | 67 | 20 | 47 | - | - |
| Evaluation and assessment (exam/pass/fail grading) | | 30 | 20 | 10 | - | - |
| **Course workload** | Academic hour | **216** | **108** | **108** | - | - |
| | Credit unit | **6** | **3** | **3** | - | - |

## 5. COURSE CONTENTS

*Table 5.1 Content of the course (module) by type of academic work*

| **Modules** | **Content of the modules (topics)** | **Types of academic activities** |
|---|---|---|
| Module 1. Systematics, morphology and structure of microorganisms | Topic 1.1. The concept of the taxonomy and classification of microorganisms. Taxonomic categories. The principles of modern classification of bacteria according to Burgey. Prokaryotes and eukaryotes. Basic forms and polymorphism of bacteria. The structure of the bacterial cell. Features of the morphology and structure of spirochetes, actinomycetes, mycoplasmas, rickettsia, chlamydia. | Lectures, Lab work. |
| Module 2. Physiology of microorganisms | Topic 2.1. The chemical composition of the bacterial cell. Enzymes of microorganisms, their classification. Microorganism nutrition. The essence and types of biological oxidation of substrates by | Lectures, Lab work. |

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| | microorganisms. Classification of microbes by the type of respiration. The growth and reproduction of microorganisms. Culture media for the cultivation of microorganisms and requirements for them, classification of culture media. Features of the cultivation of strict anaerobes. The concept of cultural, enzymatic and other properties of microbes. | |
| Module 3. The influence of environmental factors on microorganisms | Topic 3.1. The influence of physical factors. The concept of sterilization and asepsis. The action of chemicals. The concept of disinfection and antiseptics. The action of biological factors on microorganisms. Colicins. Bacteriophages. Nature, properties, structural features. Practical application of bacteriophages in veterinary medicine. Antibiotics Antibiotic producers, principles of their production. Mechanism and spectrum of action of antibiotics. Antibiotic resistance of microbes. | Lectures, Lab work. |
| Module 4. Microorganism genetics | Topic 4.1. The concept of heredity and variability. Genetic code and information transfer. The concept of genome, genotype and phenotype. Chromosomal and extrachromosomal genetic determinants (plasmids). The nature of microbial variability. Phenotypic manifestation of variability (dissociation, modification). Genotypic variability. Spontaneous and induced mutations in bacteria. Recombination variability in bacteria. Polymerase chain reaction (PCR), DNA probes. The value of the doctrine of the variability of microbes in the diagnosis and specific prevention of infectious diseases. | Lectures, Lab work. |
| Module 5. The spread of microorganisms in nature | Topic 5.1. Microorganisms as symbiotic partners: mutualism, commensalism, parasitism, antagonism. Microflora of soil, water and air. Microflora of the body of animals. Dysbacteriosis, its causes and methods of correction. Normal microflora and its protective function. Probiotics for veterinary use. | Lectures, Lab work. |
| Module 6. Fundamentals of Sanitary Microbiology | Topic 6.1. The purpose and objectives of sanitary and microbiological research of objects of veterinary supervision. Sanitary indicative microorganisms, characteristics of their properties. Principles of sanitary and microbiological research of water, soil, air of livestock buildings. Sanitary assessment of environmental objects for microbiological indicators. Transmission of | Lectures, Lab work. |

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| | pathogens of infectious diseases through water, soil and air.<br>Microflora of manure. Microbiological processes of utilization of fiber, protein and other compounds in manure, depending on the storage method (aerobic, aerobic-anaerobic, anaerobic). Survival of pathogenic microorganisms in manure.<br>Microflora of feed. Microbiological bases of green plant conservation (silage, haylage, hay). Principles of sanitary and microbiological assessment of the good quality of concentrated, juicy, roughage and animal feed. Indication of pathogenic microbes and microbial toxins in feed.<br>Causative agents of foodborne diseases and toxicosis. Principles and methods of their diagnosis. | |
| Module 7. Fundamentals of the doctrine of infection | Topic 7.1. Definition of the concept "infection - infectious process". Infectious disease. Stages of development and clinical manifestations of an infectious disease. The concept of sepsis, bacteremia, toxemia, septicopyemia. Microbearer. The concept of pathogenicity and virulence of microbes. Virulence units. The main factors of pathogenicity. | Lectures, Lab work. |
| Module 8. Immunity | Topic 8.1. Definition of the concept of "immunity". The immune system and its functions. Central and peripheral organs of the immune system. Function of T and B lymphocytes. Cooperative relationships in the immune response with the participation of histocompatibility complex antigens, phagocytes, T- and B-lymphocytes. Forms of the immune response: synthesis of antibodies and cellular factors, immunological memory, tolerance, allergy. Antigens. The concept of "antigen". Antigens of animal origin and bacterial cells. Antigenic determinants (epitopes) of bacteria. The main properties of a complete antigen. Antigenic specificity. Haptens and their properties.<br>Antibodies. The concept of antibodies. Their nature and function. The structure of immunoglobulins of various classes. The concept of the active center of antibodies. Primary and secondary immune responses. Antigen-antibody interaction phenomena. Serological reactions. Allergy. The concept of allergies, its types. Hypersensitivity of | Lectures, Lab work. |

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| | immediate and delayed types. The mechanism of development of both types of hypersensitivity. Infectious allergy. Immunological tolerance. Factors contributing to tolerance. Types of immunity. The concept of the natural resistance of a macroorganism. Inherited resistance factors. Acquired immunity: post-infectious, post-vaccination, active and passive, colostral, antitoxic, sterile and non-sterile; local immunity. Biologicals. Principles of control for sterility, harmlessness, reactogenicity and activity. | |
| Module 9. Causative agents of staphylococcosis and streptococcosis | Topic 9.1. General characteristics of the main taxonomic groups. Spreading. Role in animal and human pathology. Staphylococci. Characterization of morphological, tinctorial, cultural and enzymatic properties of the main types of staphylococci. Pathogenic factors. Methods for their identification. Antigenic structure. Stability. Drug resistance. Sampling of material for research. Bacteriological diagnosis of infections of staphylococcal etiology. Differentiation from non-pathogenic staphylococci. Features of immunity. Biologicals for specific prophylaxis of staphylococcosis.<br>Streptococci. Significance in animal and human pathology. General characteristics of biological properties. Toxins and pathogenic factors. Antigenic structure. Classification of pathogenic streptococci. Immunogenic properties and post-infectious immunity.<br>The causative agent of myta. Morphology, tinctorial, cultural and enzymatic pathogenic properties. Pathological material and bacteriological diagnostics of myta. Differentiation of the pathogen of myta from other types of streptococci. Formation of immunity. Biologicals.<br>The causative agent of mastitis. Morphology, tinctorial, cultural and enzymatic properties, pathogenicity. Bacteriological diagnosis of streptococcal mastitis. Differentiation of streptococcus mastitis from other types of streptococci. Features of immunity. Used biological products.<br>The causative agent of pneumococcal infection (septicemia) of young animals. | Lectures, Lab work. |

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| | Morphology, tinctorial, cultural, enzymatic properties, pathogenicity. Age susceptibility of farm animals. Selection of pathological material for research on pneumococcal infection. Bacteriological diagnostics. Immunity. Used biological products. | |
| Module 10. Enterobacteriaceae | Topic 10.1. General characteristics. Classification. Role in the pathology of farm animals.<br>The causative agent of colibacillosis. The role of E. coli in the etiology of colibacillosis of young farm animals, edematous disease of piglets. Age susceptibility of farm animals. Antigenic structure. Morphology, tinctorial, cultural and enzymatic properties, pathogenicity. Selection of material and bacteriological diagnosis of colibacillosis. Scheme of bacteriological research. Serological identification of the causative agent of colibacillosis. Features of immunity in escherichiosis. Biologicals.<br>Causative agents of salmonellosis. Significance in human and animal pathology. Age susceptibility of farm animals; the importance of the carrier of bacteria in adult animals; sensitivity of laboratory animals. Antigenic structure. Salmonella persistence. Morphology, tinctorial, cultural and enzymatic properties, pathogenicity. Selection of material for research. Scheme of bacteriological research. Serological identification (serogroups). Features of immunity. Biologicals. | Lectures, Lab work. |
| Module 11. The causative agents of pig erysipelas and listeriosis | Topic 11.1. The causative agent of pig erysipelas. Distribution in nature and significance in human and animal pathology. Basic biological properties. Spectrum of pathogenicity. Stability in the external environment. Laboratory diagnostics. Differentiation of erysipelas from listeria and the causative agent of septicemia in mice. Immunity. Biologicals.<br>The causative agent of listeriosis. Distribution in nature and significance in the pathology of animals and humans. Basic biological properties. Susceptibility of farm animals. Resistance of Listeria to low temperatures and other physicochemical factors. Selection of pathological material. | Lectures, Lab work. |

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| | Laboratory diagnostics of listeriosis. Differentiation of listeria from the causative agent of swine erysipelas. Immunity. Biologicals. | |
| Module 12. Pathogenic mycobacteria | Topic 12.1. General characteristics of the mycobacteria family. Features of morphology and chemical composition. The role of mycobacteria in the etiology of tuberculosis and paratuberculosis.<br>The causative agents of tuberculosis of farm animals. Characterization of tinctorial and cultural properties of Mycobacterium tuberculosis. Pathogenicity for agricultural and laboratory animals. The peculiarity of preparing material for research. Laboratory diagnostics of tuberculosis. Differentiation of pathogenic mycobacteria from acid-fast saprophytes and fast-growing mycobacteria. Allergic and serological diagnosis of tuberculosis. Immunity. Biologicals.<br>The causative agent of paratuberculosis (paratuberculosis enteritis) in cattle. Spreading. Biological characteristics of the pathogen. Antigenic structure. Laboratory diagnostics of paratuberculosis. Differentiation of paratuberculosis mycobacteria from mycobacterium tuberculosis. Allergic diagnostics. Immunity and specific prevention of paratuberculosis. | Lectures, Lab work. |
| Module 13. Causative agents of zoonotic infections | Topic 13.1. The causative agent of anthrax. Discovery history. Spreading. Stability in the external environment. Role in animal and human pathology. Features of the morphology of the microorganism. Capsule and sporulation. Tinctorial properties, cultural characteristics, enzymatic activity, toxigenicity, antigenic properties. Selection of pathological material. Safety at work. Laboratory diagnostic methods. Research of leather and fur raw materials for anthrax. Differentiation from soil saprophytic bacilli. Immunity. Diagnostic, preventive and therapeutic biological products.<br>The causative agent of brucellosis. Discovery history. Role in human and animal pathology. Resistance to physical and chemical factors. Morphology, tinctorial properties, peculiarities of cultivation and enzymatic properties of various species of brucella. Pathogenicity. | Lectures, Lab work. |

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| | Antigenic structure. Selection of material for research. Laboratory diagnostic methods. Scheme of bacteriological research. Serological diagnosis of brucellosis. Allergic diagnostics and features of immunity. Diagnostic and preventive biological products.<br>The causative agent of tularemia. Discovery history. Role in animal pathology. Morphology, tinctorial, cultural and biochemical properties, pathogenicity, antigenic structure. Selection of material for research. Laboratory diagnostic methods. The value of the allergic test. Immunity. Biologicals. | |
| Module 14. Yersinia | Topic 14.1. The causative agent of the zooanthroponous plague. Discovery history. Spreading. The susceptibility of animals and humans. Main morphological, tinctorial, cultural and enzymatic properties; pathogenicity, antigenic structure. Stability. Selection of material for research. Plague bacteriological diagnostics. Precautions and safety measures during laboratory research. Differentiation of the causative agent of the zooanthroponous plague from Yersinia pseudotuberculosis. Biologicals.<br>The causative agent of pseudotuberculosis. Spreading. The susceptibility of animals and humans. Main morphological, tinctorial, cultural and enzymatic properties; pathogenicity, antigenic structure. Selection of material for research. Bacteriological diagnostics. | Lectures, Lab work. |
| Module 15. The causative agent of pasteurellosis | Topic 15.1. Discovery history. Pasteurelling and the significance of this phenomenon in animal pathology. Morphological, tinctorial and other biological properties of the pathogen. Susceptibility of agricultural and laboratory animals and birds. Resistance of pasteurella to physical and chemical factors. Laboratory diagnostics of pasteurellosis. Biologicals. | Lectures, Lab work. |
| Module 16. Pathogenic anaerobes | Topic 16.1. Clostridia are the causative agents of anaerobic infections. Discovery history. General characteristics of biological properties. Significance in animal and human pathology. Stability in the external environment. Range of pathogenicity and toxins. Selection of | Lectures, Lab work. |

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| | pathological material and laboratory diagnosis of emphysematous carbuncle, malignant edema, tetanus, botulism, bradzot, anaerobic lamb dysentery, sheep enterotoxemia. Application of the neutralization reaction to identify and determine the type of toxins of pathogenic clostridia. Formation of immunity in clostridiosis. Used biological products. | |
| Module 17. Causative agents of necrobacteriosis and hoof rot | Topic 17.1. The susceptibility of animals. General characteristics. Morphology, tinctorial, cultural and enzymatic properties, pathogenicity. Toxins. Pathogenesis. Antigenic structure. Selection of pathological material. Bacteriological diagnostics. Differentiation of pathogens. Immunity. Biologicals. | Lectures, Lab work. |
| Module 18. Pathogenic pseudomonas | Topic 18.1. The causative agent of glanders. Discovery history. Role in animal pathology. Morphology, tinctorial, cultural and enzymatic properties. Stability. Pathogenic properties. Antigenic structure. Selection of pathological material. Bacteriological and serological diagnostics. Allergic diagnosis. Feature of immunity.<br>The causative agent of melioidosis. General characteristics. Material for research. Laboratory diagnostics (bacteriological and serological). Immunity. Used biological products | Lectures, Lab work. |
| Module 19. Pathogenic mycoplasmas and chlamydia | Topic 19.1. History of discovery. Distribution in nature, significance in human and animal pathology. Classification of mycoplasmas and chlamydia. The causative agents of mycoplasmosis of farm animals and birds: pleuropneumonia of cattle, pleuropneumonia of goats, infectious agalactia of sheep and goats, respiratory mycoplasmosis of birds. The main types of chlamydiae - the causative agents of ornithosis, chlamydia of sheep, cattle and other animal species. Features of morphology, cultural and antigenic properties, the spectrum of pathogenicity. Resistance. The difference between mycoplasmas and L-forms of bacteria. Features of laboratory diagnosis in the study for mycoplasmosis and chlamydia. Immunity. Biopreparations. | Lectures, Lab work. |
| Module 20. Pathogenic rickettsia | Topic 20.1. Discovery history. Significance in human and animal pathology. Ecology of rickettsia. The role of insect vectors in the | Lectures, Lab work. |

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| | distribution and circulation of rickettsia in nature. The main types of rickettsia and chlamydia - the causative agents of rickettsiases (Q fever, kerataconjunctivitis and cattle coudriosis, canine ehrlichiosis) Biological characteristics of rickettsia. Spectrum of pathogenicity and resistance. Laboratory diagnostics of rickettsioses. Immunity. Specific prophylaxis. | |
| Module 21. Causative agents of campylobacteriosis and leptospirosis | Topic 21.1. Causative agents of campylobacteriosis. Distribution and significance in the pathology of farm animals. Features of morphology and biological properties. Susceptibility of agricultural and laboratory animals. Campylobacter resistance. Laboratory diagnostics. Differentiation of pathogenic and saprophytic campylobacter.<br>Causative agents of leptospirosis. Distribution of pathogenic and saprophytic leptospira in nature. Significance in human and animal pathology. Features of morphology, cultural and pathogenic properties. Susceptibility of farm animals. Leptospira resistance to physical and chemical factors and in the environment. Laboratory diagnostics. Differentiation of leptospira. Application of PMA and RA for serological diagnosis of leptospirosis. Immunity in leptospirosis. Biologicals. | Lectures, Lab work. |
| Module 22. Causative agents of mycoses and mycotoxicosis | Topic 22.1. The causative agents of mycoses (mucor, penicilli, aspergillus, etc.). Distribution in nature, importance in the pathology of farm animals and humans, biological properties of pathogens. Pathogenicity factors, resistance. Selection of material for research. Laboratory diagnostics of mold mycoses. Causative agents of mycoses caused by yeast-like fungi. Characteristics of the properties of the causative agents of candidiasis, coccidioidomycosis, epizootic lymphangitis, etc. The circle of susceptible animals. Selection of material for research. Laboratory diagnostics.<br>Causative agents of dermatomycosis. The susceptibility of animals. Morphology of pathogens of trichophytosis and microsporia. Selection of material for research. Laboratory diagnostics of dermatomycosis. Criteria for differentiation | Lectures, Lab work. |

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| | of pathogens of trichophytosis and microsporia. Biologicals. | |
| Module 23. Causative agents of protozoal infections | Topic 23.1. Classification of protozoal animal diseases. General scheme of the development cycle of sporozoans. Causative agents of protozoal diseases of farm animals and birds: pyroplasmidosis of cattle and small ruminants, equids, dogs (piroplasmosis, babesiosis, nutalliosis, fransaiellosis), theileriosis of cattle, coccidiosis (eimeriosis, sarcocystosis, erythrocyte) , chickens, sarcocystosis of cattle and small ruminants, mastigophorosis (surra and equine disease), pig balantidiosis. Development cycles, sources of infections, localization of pathogens in the host's body, pathogenesis, prevention. | Lectures, Lab work. |

## 6. COURSE EQUIPMENT AND TECHNOLOGY SUPPORT REQUIREMENTS

*Table 6.1. Material and technical support of the course*

| ***Classroom for Academic Activity Type*** | ***Equipping the classroom*** | **Specialized educational/laboratory equipment, software and materials for the development of the course** (if necessary) |
|---|---|---|
| Lecture | An auditorium for conducting lecture-type classes, equipped with a set of specialized furniture; a board (screen) and technical means of multimedia presentations. | *-gas burners*<br>*-Biomed-5 microscopes*<br>*laboratory dry-air thermostat*<br>*-refrigerator*<br>*-aerostat*<br>*-PCYa-10 cavoscope*<br>*-vacuum filtration device PVF-35/1NB*<br>*-instruments*<br>*- laboratory glassware*<br>*-dye set*<br>*- nutrient media*<br>*-microorganism cultures*<br>*-When making experiments in laboratory classes, scientific equipment of bacteriological laboratory is used (centrifuges, autoclave, dry-heat chamber).* |

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| Laboratory | An auditorium for laboratory work, individual consultations, routine monitoring and interim certification, equipped with a set of specialized furniture and equipment. | *-gas burners*<br>*-Biomed-5 microscopes*<br>*laboratory dry-air thermostat*<br>*-refrigerator*<br>*-aerostat*<br>*-PCYa-10 cavoscope*<br>*-vacuum filtration device PVF-35/1NB*<br>*-instruments*<br>*- laboratory glassware*<br>*-dye set*<br>*- nutrient media*<br>*-microorganism cultures*<br>*-When making experiments in laboratory classes, scientific equipment of bacteriological laboratory is used (centrifuges, autoclave, dry-heat chamber).* |
| Self-studies | An auditorium for independent work of students (can be used for seminars and consultations), equipped with a set of specialized furniture and computers with access to an electronic information and educational environment. | |

## 7. RESOURCES RECOMMENDED FOR COURSE STUDIES

*Main readings:*


1. Kolychev N.M., Gosmanov R.G. Veterinary microbiology and mycology. SPb, Ed. Doe, 2014. http://lib.rudn.ru/MegaPro/UserEntry?Action=Rudn_FindDoc&id=465191&idb=0.
2. Kislenko V.N. Veterinary Microbiology and Immunology. SPb, Ed. Doe, 2016. http://lib.rudn.ru/MegaPro/UserEntry?Action=Rudn_FindDoc&id=449945&idb=0.
3. Gosmanov R.G., Galiullin A.K., Volkov A.Kh., Ibragimova A.I. Microbiology. SPb, Ed. Doe, 2017. http://lib.rudn.ru/MegaPro/UserEntry?Action=Rudn_FindDoc&id=465013&idb=0.
4. Gosmanov R.G., Kolychev N.M., Novitsky A.A. Fundamentals of the doctrine of infection and antimicrobial immunity. SPb, Ed. "Doe", 2017. http://lib.rudn.ru/MegaPro/UserEntry?Action=Rudn_FindDoc&id=465046&idb=0
5. Gosmanov R.G., Kolychev N.M. Workshop on Veterinary Microbiology and Mycology. SPb, Ed. Doe, 2014.


*Additional Readings:*


1. Sarukhanova L.E., Volina E.G., Yashina N.V. General microbiology, virology and applied immunology. Moscow, Ed. RUDN, 2020. http://lib.rudn.ru/MegaPro/UserEntry?Action=Rudn_FindDoc&id=491251&idb=0.

2. Gosmanov R.G., Kolychev N.M., Novitsky A.A. and other Brief dictionary of microbiological, virological, immunological and epizootic terms. SPb, Ed. Doe, 2017. http://lib.rudn.ru/MegaPro/UserEntry?Action=Rudn_FindDoc&id=465045&idb=0.
3. Gosmanov R.G., Volkov A.Kh., Galiullin A.K., Ibragimova A.I. Sanitary microbiology. SPb, Ed. Doe, 2018. http://lib.rudn.ru/MegaPro/UserEntry?Action=Rudn_FindDoc&id=466528&idb=0.

*Internet sources*

1. Electronic libraries (EL) of RUDN University and other institutions, to which university students have access on the basis of concluded agreements:

- RUDN Electronic Library System (RUDN ELS) http://lib.rudn.ru/MegaPro/Web
- EL "University Library Online" http://www.biblioclub.ru
- EL "Yurayt" http://www.biblio-online.ru
- EL "Student Consultant" www.studentlibrary.ru
- EL "Lan" http://e.lanbook.com/
- EL "Trinity Bridge"

2.*Databases and search engines:*

- electronic foundation of legal and normative-technical documentation http://docs.cntd.ru/
- Yandex search engine https:// www .yandex.ru/
- Google search engine https://www.google.ru/
- Scopus abstract database http://www.elsevierscience.ru/products/scopus/

Educational and methodological materials for independent work of students during the development of the course/ module*:

1. A course of lectures on the course "**Veterinary microbiology and mycology**".
2. Laboratory workshop on the course "**Veterinary microbiology and mycology**".

* - The training toolkit and guidelines for the internship are placed on the internship page in the university telecommunication training and information system under the set procedure.

## 8. ASSESSMENT TOOLKIT AND GRADING SYSTEM* FOR EVALUATION OF STUDENTS' COMPETENCES LEVEL AS COURSE RESULTS

The assessment toolkit and the grading system* to evaluate the level of competences (competences in part) formation as the course results are specified in the Appendix to the course syllabus.

* The assessment toolkit and the grading system are formed on the basis of the requirements of the relevant local normative act of RUDN University (regulations / order).

**DEVELOPER:**

| Associate Professor of the Department of Microbiology and Virology | | Yashina N.V. |
|---|---|---|
| Position, Basic curriculum | Signature | Full name. |

**HEAD OF EDUCATIONAL DEPARTMENT:**

| Department of Microbiology and Virology | | Podoprigora I.V. |
|---|---|---|
| Name Basic Curriculum | Signature | Full name. |

**HEAD OF**
**HIGHER EDUCATION PROGRAMME:**

| Director of the Department of Veterinary Medicine | | Vatnikov Yu.A. |
|---|---|---|
| Position, Basic curriculum | Signature | Full name |