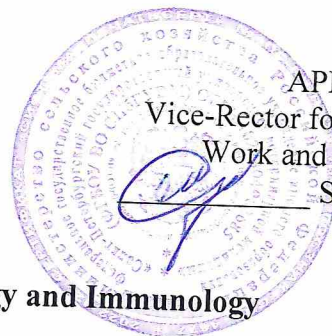


Документ подписан простой электронной подписью
Информация о владельце:
ФИО: Сухинин Александр Александрович
Должность: Проректор по учебно-воспитательной работе
Дата подписания: 02.02.2025 12:35:23
Уникальный программный ключ:
e0eb125161f4cee9ef898b5de88f5c7dcefdc28a

Ministry of Agriculture of the Russian Federation
Federal State Budgetary Educational Institution
of Higher Education
"St. Petersburg State University of Veterinary Medicine"



APPROVED BY
Vice-Rector for Educational
Work and Youth Policy
Sukhinin A.A.
May 6, 2024

Department of Microbiology, Virology and Immunology

EDUCATIONAL WORK PROGRAM

for the discipline

" BIOTECHNOLOGY"

The level of higher education
SPECIALIST COURSE

Specialty 36.05.01 Veterinary Medicine
Full-time education
Education starts in 2024

Reviewed and adopted
at the meeting of the department
on May 2, 2024.
Protocol No. 15

Head of the Department of Microbiology,
Virology and Immunology,
Doctor of Veterinary Medicine, Professor
Sukhinin A.A.

Saint Petersburg
2024

1. GOALS AND OBJECTIVES OF THE DISCIPLINE

The main goal of the discipline "Biotechnology" is to give students theoretical knowledge and practical skills in the basic industrial methods of production of biological products, identification, isolation, separation, purification and design of biologically active substances, as well as the creation of new active forms of organisms, absent in nature.

To achieve this goal, it is necessary to solve the following tasks:

- familiarizing students with the nature and diversity of biotechnological processes, achievements of biotechnology in the field of veterinary medicine;
- study of the technology for obtaining industrial nutrient media for the cultivation of various microorganisms;
- study of conditions affecting the rate of microbiological processes, growth and development of microbial populations;
- optimization of the microbial process;
- developing practical skills in isolating production strains of microorganisms, their selection, storage, and use for the industrial production of vaccines and antigens;
- study of the technology for preparing therapeutic and diagnostic serums and gamma globulins, probiotics, antibiotics, enzymes, vitamins, etc.;
- study of the technology for obtaining recombinant DNA, genetically engineered vaccines and monoclonal antibodies and their use in veterinary medicine;
- study of methods of control, standardization and certification of biological products and certification of production lines;
- study of the devices of the main production equipment for the preparation of nutrient media and dosage forms of drugs; familiarization with the divisions of biological enterprises, organization and management of biological production using modern electronic technology;
- study of promising and environmentally friendly technological processes based on the use of microorganisms.

2. LIST OF PLANNED LEARNING RESULTS IN THE DISCIPLINE (MODULE), CORRELATED WITH THE PLANNED RESULTS OF MASTERING THE EDUCATIONAL PROGRAM

As a result of mastering the discipline, the student prepares for the following types of activities, in accordance with the educational standard of Federal State Educational Standard of Higher Education 36.05.01 "Veterinary Medicine".

Area of professional activity:

13 Agriculture

Types of professional activity tasks:

- Medical;
- Expert control
- Scientific and educational

Student competencies formed as a result of mastering the discipline

Studying the discipline should form the competence PC-5 - To carry out plan of animal treatment, based on the stated diagnosis and animals individual characteristics, signature of necessary remedies of chemical and biological nature for the treatment, taking into account combination of its pharmacological effect on the animal body. PC-5ID-7 - To know the pharmacological and toxicological characteristics of medicinal raw materials, remedies of chemical and biological nature, biologically active additives for the prevention and treatment of animal diseases of various etiology.

1. 1. Planned results of mastering competencies taking into account professional standards

Competence	Category competencies	Category			Base (PS, analysis experience)
		Know	Be able to	Own	
PC-5 ID-7	Professional skills	pharmacological and toxicological characteristics of medicinal raw materials, drugs, biological products and biologically active additives, rules for the production, storage, quality and sale of biological and other veterinary drugs intended for the prevention of diseases and treatment of animals.	analyze the effects of drugs, decipher the mechanisms of formation of reflex and humoral responses during the action of drugs on the animal's body, control the production of drugs and biological products.	skills in the use of drugs, biological products, biologically active additives for the prevention and treatment of animal diseases of various etiologies, as well as pharmacological terminology.	PC 13.012

3. THE PLACE OF DISCIPLINE IN THE STRUCTURE OF THE MPEP

Discipline B1.V.02 "Biotechnology" is a part discipline formed by participants in educational relations of the federal state educational standard of higher education in the specialty 36.05.01 "Veterinary Medicine" (specialty level).

Mastered in the 6th semester for full-time study.

When teaching the discipline "Biotechnology", the knowledge and skills acquired by students in mastering the disciplines of organic, inorganic, analytical and physical and colloidal chemistry, biological chemistry and physics, veterinary microbiology and mycology, genetics, physiology and anatomy of animals, pathological physiology of animals and pathological animal anatomy, clinical diagnostics.

Disciplines for which the discipline "Biotechnology" is a predecessor:

- 1) clinical diagnosis;
- 2) immunology;
- 3) pathological anatomy and forensic veterinary examination;
- 4) general and private surgery;
- 5) obstetrics and gynecology;
- 6) veterinary and sanitary examination;
- 7) epizootology and infectious diseases.

4. SCOPE OF THE DISCIPLINE "BIOTECHNOLOGY"

4.1. Scope of the discipline "Biotechnology" for full-time study

Type of educational work	Total hours	Semester 6
Classroom lessons (total)	32	32
Including:		
Lectures, including interactive forms	16	16
Practical exercises (PP), including interactive forms, including:	16	16
practical training (PT)	6	6
Independent work (total)	40	40
Type of intermediate certification (pass)	Test	Test
Total labor intensity hours	72	72
Credits	2	2

5. CONTENT OF THE DISCIPLINE "BIOTECHNOLOGY"
5.1. Contents of the discipline "Biotechnology" for full-time study

№	Name	Formed competencies	Semester	Types of academic work, including independent work of students and labor intensity (in hours)			
				L	PP	PT	IW
1.	Biotechnology as a science. Challenges and prospects of biotechnology in the 21st century. History of the creation of preventive drugs against infectious diseases (three periods). The latest methods of obtaining, transforming and improving food products Agricultural biotechnology. Industrial biotechnology human activity. Environmental biotechnology.	PC-5; ID-7	6	2	2		4
2.	Characteristics of production premises, equipment of structural divisions	PC-5; ID-7	6	2		2	4
3.	Microbial, plant, animal cells as the basis of modern biotechnology. Obtaining producers using genetic and cell engineering. Exo- and endometabolites as target products of biotechnology. The accumulation and processing of biomass is a method of obtaining cellular components. Obtaining exometabolites.	PC-5; ID-7	6	2	2	1	5
4.	Technology for the production of hydrolysates, extracts, infusions, as the basis for obtaining industrial nutrient media. Basic requirements for the production of nutrient media for microorganisms. Classification of nutrient media by purpose (simple, industrial, special).	PC-5; ID-7	6	2		1	5
5.	Deep and surface methods of cultivating microorganisms. The main stages of the technological process of deep cultivation of microorganisms in bioreactors (fermenters)	PC-5; ID-7	6	2			4
6.	Methods for isolating and concentrating biological products and products of microbial synthesis in product form (degree of purity and degree of concentration).	PC-5; ID-7	6				4
7.	Modern classification of vaccines. Technology for the production of live vaccines from artificially weakened strains. Methods for attenuation of virulent strains of microorganisms.	PC-5; ID-7	6	2	2		4
8.	Preparation of diagnostic immune sera, antigens, allergens, bacteriophages. Prescription of diagnostic drugs. Features of the preparation of erythrocyte diagnosticums.	PC-5; ID-7	6	2	2		4

9.	Biodegradation of agricultural waste. Recycling of solid and liquid waste using biomethanogenesis. Biological methods for treating wastewater and emissions. Bionanotechnology.	PC-5; ID-7	6	2	2	2	6
TOTAL FOR SEMESTER 6				16	10	6	40

6. LIST OF EDUCATIONAL AND METHODOLOGICAL SUPPORT FOR INDEPENDENT WORK OF STUDENTS

6.1. Guidelines for independent work

1. Zaspá, L.F. Biotechnology in animal husbandry: guidelines / L.F. Zaspá, A.M. Ukhverov. - Samara: SamSAU, 2019. - 27 p. — Text: electronic // Electronic library system "Lan": [website]. — URL: <https://e.lanbook.com/book/123525> (access date: 04/27/2024). — Access mode: for authorization. users.

6.2. Literature for independent work

- 1) Suhovolsky, O.K. The importance of biotechnology in modern animal husbandry / O.K. Suhovolsky // News of the St. Petersburg State Agrarian University. - 2019. - No. 1. - P. 102-107. — ISSN 2078-1318. — Text: electronic // Electronic library system "Lan": [website]. — URL: <https://e.lanbook.com/journal/issue/310962> (date of access: 04/27/2024). — Access mode: for authorization. users.
- 2) Plotnikova, L.Ya. Agricultural biotechnology / L.Ya. Plotnikova. - Omsk: Omsk State Agrarian University, 2014. - 80 p. — Text: electronic // Electronic library system "Lan": [website]. — URL: <https://e.lanbook.com/book/60692> (access date: 04/27/2024). — Access mode: for authorization. users.

7. LIST OF BASIC AND ADDITIONAL LITERATURE REQUIRED FOR MASTERING THE DISCIPLINE "BIOTECHNOLOGY"

a) basic literature:

- 1) Akimova, S.A. Biotechnology: textbook / S.A. Akimova, G.M. Firsov. — 2nd ed. — Volgograd: Volgograd State Agrarian University, 2018. — 144 p. — Text: electronic // Electronic library system "Lan": [website]. — URL: <https://e.lanbook.com/book/112369> (access date: 04/27/2024). — Access mode: for authorization. users.
- 2) Virology and biotechnology: textbook / R.V. Belousova, E.I. Yarygina, I.V. Tretyakov [and others]. — 3rd ed., erased. - St. Petersburg: Lan, 2018. - 220 p. — ISBN 978-5-8114-2266-1. — Text: electronic // Electronic library system "Lan": [website]. — URL: <https://e.lanbook.com/book/103898> (access date: 04/27/2024). — Access mode: for authorization. users.

b) additional literature:

- 1) Mishanin, Yu.F. Biotechnology of rational processing of animal raw materials: textbook / Yu.F. Mishanin. - St. Petersburg: Lan, 2017. - 720 p. — ISBN 978-5-8114-2562-4. — Text: electronic // Electronic library system "Lan": [website]. — URL: <https://e.lanbook.com/book/96860> (access date: 04/27/2024). — Access mode: for authorization. users.
- 2) Yakupov, T.R. Molecular biotechnology: textbook / T.R. Yakupov, T.Kh. Faizov. — St. Petersburg: Lan, 2019. — 160 p. — ISBN 978-5-8114-3719-1. — Text: electronic // Electronic library system "Lan": [website]. — URL: <https://e.lanbook.com/book/123684> (access date: 04/27/2024). — Access mode: for authorization. users.
- 3) Biotechnology: 2019-08-27 / compiled by E.G. Fedorchuk. — Belgorod: BelGSHA

im. V.Ya. Gorina, 2014. - 201 p. — Text: electronic // Electronic library system "Lan": [website]. — URL: <https://e.lanbook.com/book/123383> (access date: 04/27/2024). — Access mode: for authorization. users.

8. LIST OF RESOURCES OF THE INTERNET INFORMATION AND TELECOMMUNICATION NETWORK NECESSARY FOR MASTERING THE DISCIPLINE "BIOTECHNOLOGY"

- 1. <http://www.biotechnolog.ru/>
- 2. <https://meduniver.com> – Medical information site.
- 3. <http://www.cellbiol.ru/>
- 4. <http://www.mobot.org/MOBOT/Research/APweb/>
- 5. <http://animaldiversity.ummz.umi.ch.edu/site/index.html>
- 6. <http://www.bio-economy.ru/>
- 7. <http://www.genetika.ru/journal/>
- 8. <http://www.biomos.ru/>
- 9. <http://wikipedia.org>
- 10. <http://window.edu.ru> [Electronic resource] - "Single window of access to educational resources";
- 11. <http://knigafund.ru> [Electronic resource] - "KnigaFund"

Electronic library systems:

- 1. EBS "SPBGUVM"
- 2. EBS "Publishing house "Lan"
- 3. EBS "Student Consultant"
- 4. Legal reference system "ConsultantPlus"
- 5. University information system "RUSSIA"
- 6. Full-text database POLPRED.COM
- 7. Scientific electronic library ELIBRARY.RU
- 8. Russian Scientific Network
- 9. Electronic library system IQlib
- 10. Database of international science citation indexes Web of Science
- 11. Full-text interdisciplinary database on agricultural and environmental sciences ProQuest AGRICULTURAL AND ENVIRONMENTAL SCIENCE DATABASE
- 12. Electronic books from the publishing house "Prospekt Nauki" <http://prospektnauki.ru/ebooks/>
- 13. Collection "Agriculture. Veterinary" publishing house "Kvadro" <http://www.iprbookshop.ru/586.html>
- 14. <http://www.medliter.ru/> – electronic medical library.
- 15. www.4medic.ru - information portal for doctors and students.
- Date of reference to literature sources and websites: April 27, 2024.

9. METHODOLOGICAL INSTRUCTIONS FOR STUDENTS IN MASTERING THE DISCIPLINE "BIOTECHNOLOGY"

- Methodological recommendations for students are a set of recommendations and explanations that allow the student to optimally organize the process of studying this discipline.
- The content of methodological recommendations, as a rule, may include:
 - Tips for planning and organizing the time needed to study the discipline. Description of the sequence of student actions, or "scenario for studying the discipline."
- The morning time is the most fruitful for educational work (from 8-14 o'clock), then the afternoon (from 16-19 o'clock) and the evening time (from 20-24 o'clock). The most difficult material is recommended to be studied at the beginning of each time

interval after rest. After 1.5 hours of work, a break (10-15 minutes) is required; after 4 hours of work, the break should be 1 hour. Part of the scientific organization of labor is mastering the technique of mental work. Normally, a student should devote about 10 hours a day to studying (6 hours at the university, 4 hours at home).

- Recommendations for working on lecture material
- When preparing for a lecture, the student is recommended to:
 - 1) review the recordings of the previous lecture and recall previously studied material in memory;
 - 2) it is useful to review the upcoming material of the future lecture;
 - 3) if independent study of individual fragments of the topic of the last lecture is assigned, then it must be completed without delay;
 - 4) prepare yourself psychologically for the lecture.
- This work includes two main stages: taking notes of lectures and subsequent work on lecture material.
- Note-taking means drawing up notes, i.e. a brief written statement of the content of something (oral presentation - speech, lecture, report, etc. or a written source - document, article, book, etc.).
- The method of work when taking notes on oral presentations differs significantly from the method of work when taking notes from written sources.
- By taking notes from written sources, the student has the opportunity to repeatedly read the desired passage of text, reflect on it, highlight the main thoughts of the author, briefly formulate them, and then write them down. If necessary, he can also note his attitude to this point of view. While listening to a lecture, the student must put off most of the above-mentioned work for another time, trying to use every minute to record the lecture, and not to comprehend it - there is no time left for this. Therefore, when taking notes from a lecture, it is recommended to separate fields on each page for subsequent entries in addition to the notes.
- After recording a lecture or taking notes, you should not leave work on the lecture material until you begin preparing for the test. It is necessary to do as early as possible the work that accompanies note-taking of written sources and which was not possible to do while recording the lecture - read your notes, deciphering individual abbreviations, analyze the text, establish logical connections between its elements, in some cases show them graphically, highlight main thoughts, note issues that require additional processing, in particular, teacher consultation.
- When working on the text of a lecture, the student needs to pay special attention to the problematic questions posed by the teacher when giving the lecture, as well as to his assignments and recommendations.
- For each lecture, practical lesson and laboratory work, a number is given, etc.

Recommendations for preparing for practical classes

Practical (seminar) classes constitute an important part of students' professional training. The main goal of conducting practical (seminar) classes is to develop analytical, creative thinking in students by acquiring practical skills. Practical classes are also conducted with the aim of deepening and consolidating the knowledge gained at lectures and in the process of independent work on regulatory documents, educational and scientific literature. When preparing for a practical lesson for students, it is necessary to study or repeat theoretical material on a given topic.

When preparing for a practical lesson, the student is recommended to adhere to the following algorithm;

- 1) get acquainted with the plan of the upcoming lesson;
- 2) study the literature sources that were recommended and familiarize yourself with the introductory comments to the relevant sections.

Methodological instructions for practical (seminar) classes in the discipline, along with the work program and schedule of the educational process, refer to methodological documents that determine the level of organization and quality of the educational process.

The content of practical (seminar) classes is recorded in the working curriculum of the disciplines in the sections "List of topics for practical (seminar) classes."

The most important component of any form of practical training is assignments. The basis of the assignment is an example, which is analyzed from the perspective of the theory developed in the lecture. As a rule, the main attention is paid to the formation of specific skills and abilities, which determines the content of students' activities - problem solving, laboratory work, clarification of the categories and concepts of science, which are a prerequisite for correct thinking and speech.

Practical (seminar) classes perform the following tasks:

- stimulate regular study of recommended literature, as well as attentive attention to the lecture course;
- consolidate the knowledge gained in the process of lecture training and independent work on literature;
- expand the scope of professionally significant knowledge, skills and abilities;
- allow you to check the correctness of previously acquired knowledge;
- instill skills of independent thinking and oral presentation;
- promote free use of terminology;
- provide the teacher with the opportunity to systematically monitor the level of students' independent work.

Methodological instructions for practical (seminar) classes in the discipline should be focused on modern business conditions, current regulatory documents, advanced technologies, on the latest achievements of science, technology and practice, on modern ideas about certain phenomena and the reality being studied.

Laboratory work constitutes an important part of students' professional training. They are aimed at experimental confirmation of theoretical principles and the formation of educational and professional practical skills.

Students' performance of laboratory work is aimed at:

- generalization, systematization, deepening, consolidation of acquired theoretical knowledge on specific topics of disciplines;
- formation of necessary professional skills and abilities;

The disciplines for which laboratory work is planned and their volumes are determined by the working curriculum.

Guidelines for conducting laboratory work are developed for the duration of the working curriculum and include:

- title, which indicates the type of work (laboratory), its serial number, volume in hours and name;
- Objective;
- subject and content of the work;
- equipment, technical means, tools;
- order (sequence) of work execution;
- safety and labor protection rules for this work (if necessary);
- general rules for the design of work;
- Control questions;
- tasks;
- list of references (if necessary).

The content of laboratory work is recorded in the working curriculum of the disciplines in the section "List of topics for laboratory work."

When planning laboratory work, it should be taken into account that, along with the leading goal - confirmation of theoretical principles - in the course of completing tasks,

students develop practical skills and skills in handling laboratory equipment, equipment, etc., which can form part of professional practical training, as well as research skills (observe, compare, analyze, establish dependencies, draw conclusions and generalizations, independently conduct research, document the results).

The composition of tasks for laboratory work should be planned in such a way that they can be completed efficiently by the majority of students in the allotted time.

Laboratory work as a type of educational activity should be carried out in specially equipped educational laboratories. The necessary structural elements of laboratory work, in addition to the independent activity of students, are instructions given by the teacher, as well as the organization of a discussion of the results of the laboratory work.

The completion of laboratory work is preceded by testing students' knowledge - their theoretical readiness to complete the task.

- Recommendations for working with literature.

Working with literature is an important stage of a student's independent work in mastering a subject, contributing not only to consolidation of knowledge, but also to broadening his horizons, mental abilities, memory, ability to think, present and confirm his hypotheses and ideas. In addition, research skills necessary for future professional activities are developed.

When starting to study literature on a topic, it is necessary to make notes, extracts, and notes. It is imperative to take notes on the works of theorists, which allow one to comprehend the theoretical basis of the study. For the rest, we can limit ourselves to extracts from studied sources. All extracts and quotations must have an exact "return address" (author, title of work, year of publication, page, etc.). It is advisable to write an abbreviated name of the question to which the extract or quotation relates. In addition, it is necessary to learn how to immediately compile a card index of specialized literature and publications of sources, both proposed by the teacher and identified independently, as well as refer to bibliographic reference books, chronicles of journal articles, book chronicles, and abstract journals. In this case, publications of sources (articles, book titles, etc.) should be written on separate cards, which must be filled out in accordance with the rules of bibliographic description (surname, initials of the author, title of work. Place of publication, publisher, year of publication, number of pages, and for journals articles – journal name, year of publication, page numbers). On each card, it is advisable to record the thought of the author of the book or a fact from this book on only one specific issue. If the work, even in the same paragraph or phrase, contains further judgments or facts on another issue, then they should be written out on a separate card. The presentation should be concise, accurate, without subjective assessments. On the back of the card you can make your own notes about this book or article, its contents, structure, what sources it was written on, etc.

- Explanations about working with test materials for the course, recommendations for completing homework.

Testing allows you to determine whether the actual behavior of the program corresponds to the expected behavior by performing a specially selected set of tests. A test is the fulfillment of certain conditions and actions necessary to verify the operation of the function being tested or its part. Each question in the discipline must be answered correctly by choosing one option.

- Recommendations for completing course work (if it is included in the curriculum), defining their thematic focus, goals and objectives of implementation, requirements for content, volume, design and organization of management of their preparation on the part of departments and teachers.

According to the guidelines presented in the list of guidelines.

10. EDUCATIONAL WORK

As part of the implementation of the discipline, educational work is carried out to form a modern scientific worldview and a system of basic values, the formation and development of

spiritual, moral, civil and patriotic values, a system of aesthetic and ethical knowledge and values, attitudes of tolerant consciousness in society, the formation in students of the need to work as the first vital necessity, the highest value and the main way to achieve success in life, to understand the social significance of your future profession.

11. LIST OF INFORMATION TECHNOLOGIES USED IN THE EDUCATIONAL PROCESS

11.1. Information Technology:

The educational process in the discipline provides for the use of information technologies:

- ☐ lecturing using slide presentations;
- ☐ interactive technologies (conducting lectures, dialogues, collective discussion of various approaches to solving a particular educational and professional problem);
- ☐ interaction with students via email;
- ☐ collaboration in the Electronic Information and Educational Environment of St. Petersburg State University of Computer Science: <https://spbguv.ru/academy/eios/>

11.2 Software:

List of licensed and freely distributed software, including domestically produced ones

№	Name of technical and computer training aids recommended by sections and topics of the program	License
1	MS PowerPoint	67580828
2	LibreOffice	free software
3	ОС АЛТ Образование 8	ААО.0022.00
4	АБИС "МАРК-SQL"	02202014155
5	MS Windows 10	67580828
6	System ConsultantPlus	503/KJI
7	Android ОС	free software

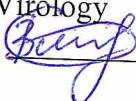
12. MATERIAL AND TECHNICAL BASE REQUIRED FOR THE IMPLEMENTATION OF THE EDUCATIONAL PROCESS IN THE DISCIPLINE "BIOTECHNOLOGY"

Name of the discipline (module), practice in accordance with the curriculum	Name of special premises and premises for independent work	Equipping special rooms and rooms for independent work
Discipline B1.V.02 "Biotechnology"	412 (196084, St. Petersburg, Chernigovskaya st., 5) Classroom for conducting seminar-type classes, group and individual consultations, ongoing monitoring and intermediate certification.	<i>Specialized furniture: tables, chairs, boards, illustrative material in the form of computer presentations, posters, demonstration material on topics.</i> <i>Technical teaching aids: laptop, projector, screen, electrical connector for Internet access.</i> <i>Laboratory tables medical laboratory metal cabinet, homogenizer, universal pH meter, comparator (Michaelis apparatus), magnetic stirrer, UV lamp, slides and cover glasses, alcohol burners, loop tank, tweezers, dye solutions, immersion oil rinse with bridges, containers with disinfectants, laboratory mixing device, bioreostat, Krotov apparatus, desiccator, microaerostat, hot air sterilizers of two different types, fume hood, water bath.</i>

Discipline B1.V.02 "Biotechnology"	422 (196084, St. Petersburg, Chernigovskaya st., 5) Classroom for conducting seminar-type classes, group and individual consultations, ongoing monitoring and intermediate certification.	<i>Specialized furniture: tables, chairs, boards, illustrative material in the form of computer presentations, posters, demonstration material on topics. Technical teaching aids: laptop, projector, screen.</i> <i>Laboratory tables, medical laboratory metal cabinet, portable UV lamp, slides and cover glasses, alcohol burners, loop tank, tweezers, dye solutions, immersion oil, rinses with bridges, containers with disinfectants, bottles for washing smears. Krotov apparatus, desiccator, microanaerostat, stands, test tubes with saline solution. Device for filtration through ceramic candles, ceramic bacterial candles, microscopes, table lamps, electric extension cord, bacteriological bath.</i>
	423 (196084, St. Petersburg, Chernigovskaya st., 5) Classroom for conducting seminar-type classes, group and individual consultations, ongoing monitoring and intermediate certification.	<i>Specialized furniture: tables, chairs, boards, illustrative material in the form of computer presentations, posters, demonstration material on topics. Technical teaching aids: laptop, projector.</i> <i>Laboratory tables, a medical laboratory metal cabinet, a dry air sterilizer, microscopes, a Koch apparatus, a water bath, a thermostat, slides and cover glasses, alcohol burners, a loop tank, tweezers, dye solutions, immersion oil rinsers with bridges, containers with disinfectant solutions, a homogenizer, a thermostat.</i>
	424 (196084, St. Petersburg, Chernigovskaya st., 5) Classroom for conducting seminar-type classes, group and individual consultations, ongoing monitoring and intermediate certification.	<i>Specialized furniture: tables, chairs, boards, illustrative material in the form of computer presentations, posters, demonstration material on topics. Technical teaching aids: laptop, projector.</i> <i>Laboratory benches, scales, centrifuge, homogenizer, Ph - meter, magnetic stirrer, electric dry-air thermostat, laminar flow box, heating mantle, portable UV lamp, fluorescent microscope, medical laboratory metal cabinet, dry-air sterilizer, microscopes, slides and cover glasses, alcohol burners, loop tank, tweezers, coloring solutions, immersion oil rinser with bridges, containers with disinfectant solutions, homogenizer, thermostat.</i>
	417 room for equipment storage and preventative maintenance.	<i>Laboratory tables, chairs, medical laboratory metal cabinet, iron cabinet (safe), household refrigerator, TS-80 thermostat, microscopes, centrifuge, laboratory cabinets.</i>
	422 room for equipment storage and preventative maintenance.	<i>Composite cabinet, desks -2, executive table, chairs, household refrigerator, laboratory table, medical glass cabinet.</i>
	206 Large reading room (196084, St. Petersburg, Chernigovskaya str., building 5) Room for independent work	<i>Specialized furniture: tables, chairs</i> <i>Technical teaching aids: computers with an Internet connection and access to the electronic information and educational environment</i>
	224 Small reading room (196084, St. Petersburg, Chernigovskaya str., building 5) Room for independent work	<i>Specialized furniture: tables, chairs</i> <i>Technical teaching aids: computers with an Internet connection and access to the electronic information and educational environment</i>
	324 Information Technology Department (196084, St.	<i>Specialized furniture: tables, chairs, special equipment, materials and spare parts for preventive</i>

	Petersburg, Chernigovskaya str., building 5) Room for storage and preventive maintenance of educational equipment	<i>maintenance of educational equipment</i>
	Box No. 3 Carpentry workshop (196084, St. Petersburg Chernigovskaya str., building 5)	<i>Petersburg, st. Chernigovskaya, house 5) Room for storage and preventive maintenance of educational equipment. Specialized furniture: tables, chairs, special equipment, materials for preventive maintenance of furniture.</i>

The work program was compiled by:

Associate Professor, Department of Microbiology, Virology
and Immunology, Candidate of Veterinary Sciences  V.O. Vinokhodov

Ministry of Agriculture of the Russian Federation
Federal State Budgetary Educational Institution
of higher education
"Saint Petersburg State University of Veterinary Medicine"

Department of microbiology, virology and immunology

FUND OF ASSESMENT TOOLS
for the discipline

BIOTECHNOLOGY

Level of higher education
SPECIALIST COURSE

Specialty 36.05.01 Veterinary medicine
Full-time education

Education starts in 2024

Saint Petersburg
2024

1. PASSPORT OF THE ASSESSMENT FUND

Table 1 №	Formable competencies	Controlled sections (topics) of the discipline	Assessment tool
1.	PC-5 ID-7	Biotechnology as a science. Challenges and prospects of biotechnology in the 21st century. Biotechnology of preventive drugs. Agricultural, industrial, environmental biotechnology.	Colloquium, tests
2.		Engineering and technical support of biotechnological processes.	Colloquium, tests
3.		Producers and target products. Characteristics of the stages of the biotechnological process.	Colloquium, tests
4.		Substrates and media for biotechnological production. Classification, preparation, sterilization.	Colloquium, tests
5.		Methods for cultivating producers. Features of surface and deep cultivation.	Colloquium, tests
6.		Methods for isolating and concentrating target products (degree of purity and degree of concentration).	Colloquium, tests
7.		Technology for the production of live vaccines and inactivated vaccines against bacterial and viral infections. Methods for attenuation of virulent strains.	Colloquium, tests
8.		Preparation of diagnostic diagnostic preparations.	Colloquium, tests
9.		Biodegradation of agricultural waste. Recycling of solid and liquid waste using biomethanogenesis. Biological methods for treating wastewater and emissions. Bionanotechnology.	Colloquium, tests

2. SAMPLE LIST OF ASSESSMENT TOOLS

Table 2			
№	Name evaluation tool	Brief description of the evaluation tool	Presentation of the assessment tool in the fund
1.	Colloquium	A means of monitoring the assimilation of educational material of a topic, section or sections of a discipline, organized as a training session in the form of an interview between a teacher and students	Questions on topics/sections of the discipline
2.	Test	A system of standardized tasks that allows you to automate the procedure measuring the level of knowledge and skills of the student	Test task fund

3. INDICATORS AND CRITERIA FOR ASSESSING COMPETENCIES AT VARIOUS STAGES OF THEIR FORMATION, DESCRIPTION OF ASSESSMENT SCALES

Planned results of mastering the competency		Mastery level			Evaluation tool
		unsatisfactory	satisfactory	good	
Studying the discipline should form the competence PC-5 - Development of a treatment plan for animals based on the established diagnosis and individual characteristics of the animals, selection of the necessary drugs of a chemical and biological nature for the treatment of animals, taking into account their total pharmacological effect on the body. PC5-ID-7 - "Know the pharmacological and toxicological characteristics of medicinal raw materials, drugs of a chemical and biological nature, biologically active additives for the prevention and treatment of animal diseases of various etiologies."					
TO KNOW: pharmacological and toxicological characteristics of medicinal raw materials, drugs of chemical and biological nature, biologically active additives for the prevention and treatment of animal diseases of various etiologies		The level of knowledge is below the minimum requirements, there were serious errors	Minimum acceptable level of knowledge, many minor mistakes were made	The level of knowledge corresponds to the training program, several minor mistakes were made	The level of knowledge corresponds to the training program, without errors.
					Colloquium, tests

Table 3

3. LIST OF CHECK TASKS AND OTHER MATERIALS REQUIRED FOR THE ASSESSMENT OF KNOWLEDGE, ABILITIES, SKILLS AND ACTIVITY EXPERIENCE

3.1. Typical tasks for ongoing progress monitoring

3.1.1. Questions for the colloquium

Questions to assess the competence of PC-5: «To carry out plan of animal treatment, based on the stated diagnosis and animals individual characteristics, signature of necessary remedies of chemical and biological nature for the treatment, taking into account combination of its pharmacological effect on the animal body». ID-7; PC-5: «**To know** the pharmacological and toxicological characteristics of medicinal raw materials, remedies of chemical and biological nature, biologically active additives for the prevention and treatment of animal diseases of various etiology».

Sources of obtaining industrial strains of producers. Taxonomic groups of producers.

1. Requirements for producers of BT processes. Microorganisms GRAS.
2. Brief description of the stages of the biotechnological process.
3. Requirements for fermenters for industrial cultivation of producers.
4. Characteristics of bioreactors by type of mixing and aeration.
5. System of heat exchange, defoaming, control and management of cultivation processes in bioreactors?
6. How is the bioreactor, air and nutrient media sterilized in preparation for industrial cultivation?
7. The main components of nutrient media for the cultivation of producers. Characterize microorganisms based on the type of carbon and nitrogen nutrition.
8. Principles of designing nutrient media. How is the composition of the nutrient medium selected for each type of producer? How is the quality of software assessed?
9. Characterize raw materials sources of plant and animal origin, as well as from production waste for constructing nutrient media.
10. What is meant by standardization and how is standardization ensured when designing a software system?
11. Storage and maintenance of production strains. Preparation of a seed (mother) culture of a producer for a biotechnological process?
12. Give a classification of methods and processes for cultivating producers. Characteristics of solid phase and liquid phase cultivation.
13. Batch cultivation. Characteristics of producer growth phases and synthesis of target products.
14. Chemostat and turbidostat cultivation modes. Characteristics of continuous cultivation.
15. Determination of the concentration of producer cells during cultivation.
16. Characteristics of the preparatory stage of BTP.
17. Methods for separating culture liquid and biomass?
18. Methods for isolating the target product from a solution after cell disintegration.
19. Methods for purification of target products.
20. Treatment of wastewater and emissions. The value of activated sludge.
21. Methods for determining residual amounts of AMPs.
22. Anaerobic methods of waste processing. Microorganisms of anaerobic biocenoses.
23. Biogas plants. Stages of biomethanogenesis during waste processing.
24. Basic principles of organizing an enterprise for the production of biological products. Auxiliary and production areas.
25. Sanitation of a biological enterprise, quality control of disinfection of surfaces and equipment.

26. The essence and tasks of genetic engineering. Stages of obtaining genetically modified producing microorganisms.
27. Methods for obtaining genes for genetic engineering.
28. Requirements for genetic vectors.
29. Vectors for transfer of genetic information into prokaryotic and eukaryotic cells.
30. Principles of creating a genetic construct for introduction into cells based on a plasmid and bacteriophage.
31. Introduction of a genetic construct into the recipient organism.
32. Identification (screening) and selection of cells that have acquired the desired gene or genes.
33. Use of transgenic plants in the world and in Russia. Methods for detecting and identifying GMO components in feed and food products.
34. Quantitative determination of the content of GMO components in feed and products?
35. Methods of cultivating cell cultures in biotechnology (monolayer, roller and suspension).
36. Cultivation of cell cultures in a monolayer. Multilayer cultivation.
37. Features of suspension cultivation. Application of microcarriers.
38. Control of biological products during release?
39. Identification of markers of development of the resistance mechanism when selecting antibacterial drugs for treatment.

Questions to assess the competence PC-5: «To carry out plan of animal treatment, based on the stated diagnosis and animals individual character rustics, signature of necessary remedies of chemical and biological nature for the treatment, taking into account combination of its pharmacological effect on the animal body».. ID-7; PC-5: «To know the pharmacological and toxicological characteristics of medicinal raw materials, remedies of chemical and biological nature, biologically active additives for the prevention and treatment of animal diseases of various etiology».

1. Test question: Growth factors are added to nutrient media:
 - a) differential diagnostic;
 - b) selective;
 - c) elective;
 - d) proteolytic.
2. Test question: Method used to sterilize glucose solution:
 - a) autoclaving;
 - b) boiling;
 - c) microfiltration;
 - d) Tyndalization.
3. Test question: Plasmids used in genetic engineering are:
 - a) parts of chromosomes;
 - b) autonomous molecules of linear DNA;
 - c) circular molecules of a double-stranded DNA molecule;
 - d) sections of the molecule and RNA.
4. Test question: Select the most preferable method of collecting embryos from cattle donors:
 - a) washing out;
 - b) surgical;
 - c) slaughter of the donor;
 - d) hormonal.
5. Test question: The protein content in a yeast cell reaches:
 - a) 20%;
 - b) 80%;
 - c) 60%;

- d) 10%;
6. Test question: Polyethylene glycol is used for:
- a) hybridization of lymphocytes and myeloma cells;
 - b) suppression of lymphocyte growth;
 - c) suppression of the growth of myeloma cells;
 - d) suppression of the growth of hybrid cells.
7. Test question: To determine the biological concentration of microorganisms in a suspension, use:
- a) optical turbidity standard;
 - b) sowing on solid nutrient media;
 - c) counting in Goryaev's cell;
 - d) Tesla apparatus.
8. Test question: What function do bumpers perform in a bioreactor:
- a) mixing;
 - b) defoaming;
 - c) aeration;
 - d) sterilization.
9. Test question: Which group of biological products do allergens belong to:
- a) stimulating;
 - b) diagnostic;
 - c) preventive;
 - d) medicinal.
10. Test question: Using rivanol to precipitate:
- a) γ -globulins;
 - b) albumins;
 - c) fibrinogen;
 - d) red blood cells.
11. Test question: Method suitable for sterilization of hyperimmune sera:
- a) autoclaving;
 - b) tyndalization;
 - c) microfiltration;
 - d) ion exchange.
12. Test question: Activated sludge used in the treatment of industrial wastewater pharmaceutical production is:
- a) sorbent;
 - b) a mixture of sorbents;
 - c) a mixture of microorganisms obtained by genetic engineering methods;
 - d) a natural complex of microorganisms.
13. Test question: Biotechnologists use a restriction enzyme that recognizes and cuts DNA molecule according to the principle:
- a) simultaneously both complementary strands of DNA;
 - b) one of the complementary DNA strands;
 - c) with a specific sequence of 2–3 nucleotide pairs;
 - d) with a specific sequence of 5–6 nucleotides.
14. Test question: The ability to convert sugars into ethyl alcohol is possessed by:
- a) *Aspergillus oryzae*;
 - b) *Aspergillus terricola*;
 - c) *Escherichia coli*;
 - d) *Bacillus subtilis*;
 - e) *Saccharomyces cerevisiae*.
15. Test question: Biotechnology uses the following as biological objects:
- a) *Pseudomonas aeruginosa*;

- b) *Staphylococcus aureus*;
 - c) *Escherichia coli*;
 - d) *Clostridium tetani*;
 - e) *Saccharomyces cerevisiae*;
 - f) culture of eukaryotic cells.
16. Test question: Objects for obtaining biotechnology products can be:
- a) strains of microorganisms isolated from the natural environment;
 - b) collections of cells and cultures;
 - c) artificially constructed strains and cells;
 - d) a, b;
 - e) a, c;
 - e) all answers are correct.
17. Test question: The main requirements for producers are:
- a) ability to grow on cheap substrates;
 - b) stability with respect to production of the substance of interest;
 - c) the presence of plasmids;
 - d) the presence of a gram-positive cell wall;
 - e) high growth rate;
 - f) the presence of a gram-negative cell wall.
18. Test question: For the period of controlled biosynthesis in the development of biotechnology characteristic:
- a) development of antibiotic production;
 - b) obtaining biotechnological products using fermentations;
 - c) obtaining amino acids and enzymes using biological objects;
 - d) obtaining transgenic plants and animals;
 - e) obtaining monoclonal antibodies.
19. Test question: Protecting cells from the penetration of foreign DNA consists of:
- a) regulation of cell membrane permeability;
 - b) enlargement of foreign DNA;
 - c) cleavage of foreign DNA;
 - d) methylation of foreign DNA;
 - e) neutralization of foreign DNA.
20. Test question: A vector molecule is:
- a) a bacterial plasmid that can be transmitted into cells;
 - b) recombinant DNA, which is easily introduced into the cell;
 - c) any DNA that is capable of transferring foreign fragments DNA;
 - d) DNA, which is stably inherited in the cell;
 - e) multicopy plasmid;
 - e) all answers are correct.
21. Test question: Sequencing is:
- a) chemical-enzymatic gene synthesis;
 - b) determination of the sequence of bases in DNA;
 - c) dividing DNA into fragments and obtaining a gene bank;
 - d) gene cloning;
 - e) dividing DNA into fragments.
22. The main producers of biogas are:
- a) nitrogen-fixing bacteria;
 - b) methanogenic bacteria;
 - c) yeast;
 - d) microsporidia.

23. Enzymes in the form of heterogeneous catalysts during immobilization proteins on the surface of the carrier can be used as:
- a) consumable reagent;
 - b) multiple reagent;
 - c) are not used as a reagent.
24. What basic properties should a cloning agent have?
- vector: a) have a limited number of cleavage sites with a specific restriction enzyme;
- b) contain a genetic marker that can be used for the selection of clones carrying hybrid DNA after introduction into sensitive cells of a mixture of DNA molecules obtained in the process in vitro recombination;
- c) should not lose replicative functions when exogenous is inserted DNA fragment; d) all of the above properties.
25. A biotechnologist needs a "gene marker" for:
- a) increasing the activity of the recombinant;
 - b) formation of competent host cells;
 - c) modification of the site of interaction of restriction enzymes with the substrate;
 - d) selection of recombinants.
26. A plasmid-based vector is preferable to a vector based on phage DNA:
- a) large sizes;
 - b) less toxicity;
 - c) high switching frequency;
 - d) absence of lysis of the host cell.
27. Isolation and purification of biosynthesis and organic synthesis products have fundamental differences at the stages of the process:
- a) everyone;
 - b) final;
 - c) first;
 - d) there are no fundamental differences.
28. Hybridization of protoplasts is possible if the cells of the original plants have:
- a) sexual compatibility;
 - b) sexual incompatibility;
 - c) compatibility is not essential.
29. For the preparation of nutrient media in the production of antibiotics It is advisable to use water:
- a) distilled;
 - b) sterile;
 - c) drinking;
 - d) from open water bodies after appropriate treatment.
30. Suspension cultures are most suitable for protoplasting:
- a) in lag phase;
 - b) in the phase of accelerated growth;
 - c) in logarithmic phase;
 - d) in the phase of slow growth;
 - e) in the stationary phase;
 - e) in the dying phase.
31. Protection of aminoglycoside producers from their own antibiotic:
- a) low affinity of ribosomes
 - b) active release;
 - c) temporary enzymatic inactivation;

d) compartmentation.

32. Producer cells are immobilized if the target product:

a) water soluble;

b) insoluble in water;

c) localized inside the cell;

d) it is the biomass of cells.

33. What raw materials are used as a source of nitrogen in production penicillin:

a) corn extract;

b) soy flour;

c) ammophos;

d) corn flour.

34. The advantages of genetically engineered insulin are:

a) high activity;

b) less allergenic;

c) less toxicity;

d) greater stability.

3.1.2 List of questions for students' independent work

Questions of independent work to assess the competence of PC-5: «To carry out plan of animal treatment, based on the stated diagnosis and animals individual character rustics, signature of necessary remedies of chemical and biological nature for the treatment, taking into account combination of its pharmacological effect on the animal body». ID-7; PC-5: «To know the pharmacological and toxicological characteristics of medicinal raw materials, remedies of chemical and biological nature, biologically active additives for the prevention and treatment of animal diseases of various etiology».

1. Describe the history of the development of the biotechnology industry over the past 40 years.
2. Why are so many different biosystems used in biotechnology?
3. How do prokaryotes differ from eukaryotes?
4. What are the main components of a liquid culture medium?
5. What is primary cell culture?
6. Sometimes the strategy for synthesizing a target protein involves producing it in the form of a chimeric protein. What is the advantage of this approach?
7. Describe the strategy for isolating the EcoRI restriction enzyme.
8. How can we increase the production of antibiotics by this strain of *Streptomyces* using genetic engineering?
9. How are enzymes used in industrial ethanol production?
10. How should the bacteria in the rumen of cows be modified to provide essential amino acids to cows?
11. What are the advantages of bioinsecticides over chemical insecticides?
12. Which parameters need to be strictly controlled when optimizing the fermentation process?
13. What concerns are associated with the development of genetic engineering?
14. How does the presence of a recombinant vaccine in a cell affect its growth?
15. What treatment is the cell suspension subjected to after fermentation is complete?
16. Which strategy would you use to purify recombinant protein secreted into the culture medium?
17. What are the advantages and disadvantages of mechanical destruction of cells compared to chemical destruction?
18. How do protease inhibitors protect plants from insects?

19. How can the mammary gland of an animal be used as a bioreactor for the production of target proteins?
20. How are the creation of genetically engineered organisms destined for release into the environment controlled?
21. How can patenting inventions influence the development of fundamental science?
22. Septic tanks, anaerobic biofilters for anaerobic wastewater treatment.
23. Bioremediation of gas-air emissions.
24. Biofilters, bioscrubbers and washed-bed bioreactors.
25. Draw up schemes for obtaining recombinant DNA and DNA cloning.
26. Draw up diagrams for diagnosing a viral disease using DNA probes.
27. Draw up schemes for producing interferon using genetic engineering.
28. Draw up schemes for obtaining DNA vaccines.
29. Draw up diagrams of the immune response in the animal's body when DNA vaccines are administered.

3.1. Typical tasks for intermediate certification

3.2.1 Questions for testing

Competency being developed: PC-5: "To carry out plan of animal treatment, based on the stated diagnosis and animals individual character rustics, signature of necessary remedies of chemical and biological nature for the treatment, taking into account combination of its pharmacological effect on the animal body". ID-7; PC-5: "To know the pharmacological and toxicological characteristics of medicinal raw materials, remedies of chemical and biological nature, biologically active additives for the prevention and treatment of animal diseases of various etiology."

1. Biotechnology: subject, sections, connections with other sciences, history of development.
2. Biological agents as elements of the biotechnological process.
3. Substrates and media as elements of the biotechnological process.
4. Equipment as an element of the biotechnological process.
5. Products of the biotechnological process.
6. Organization of the biotechnological process.
7. Biotechnology of waste processing. Biogas production.
8. Methods for treating wastewater and emissions.
9. Biotechnology for the production of live vaccines.
10. Biotechnology for the production of inactivated vaccines.
11. Biotechnology for the production of diagnostic and therapeutic serums.
12. Methods for purification and concentration of viruses.
13. Biotechnology for the production of antibiotics.
14. Microbiological methods for the production of amino acids.
15. Microbiological methods for the production of enzymes.
16. Applications and sources of enzymes.
17. Immobilized enzymes. Use in biotechnology.
18. Obtaining vitamins in a biotechnological process.
19. Biotechnological production of organic acids.
20. Types of cell and tissue cultures used in biotechnology.
21. Isolation and purification of enzyme preparations.
22. The use of cellular and genetic engineering in animal husbandry.
23. Genetic engineering method for producing insulin.
24. Genetic engineering method for producing interferon.
25. Methods for obtaining transgenic plants.

26. Types of plant cell and tissue cultures.
27. Plants are bioreactors of medicinal preparations.
28. Biotechnology for obtaining antigen and antibody erythrocyte diagnostics.
29. Biotechnology for producing allergens.
30. Biotechnology for obtaining bacteriophages.
31. Biotechnology for the production of lactic acid products.
32. Biotechnology for the production of microbial protein.

4. METHODOLOGICAL MATERIALS DETERMINING PROCEDURES FOR ASSESSING KNOWLEDGE, ABILITIES AND SKILLS AND ACTIVITY EXPERIENCE CHARACTERIZING THE STAGES OF COMPETENCY FORMATION

Criteria for assessing students' knowledge during the colloquium:

- Mark "excellent" - the student clearly expresses his point of view on the issues under consideration, giving relevant examples.
- Mark "good" - the student makes some errors in the answer
- Mark "satisfactory" - the student reveals gaps in knowledge of the basic educational and normative material.
- Mark "unsatisfactory" - the student reveals significant gaps in knowledge of the basic principles of the discipline, inability, with the help of the teacher, to obtain the correct solution to a specific practical problem.

Criteria for assessing students' knowledge during testing:

The test result is assessed on a percentage rating scale. Each student is offered a set of test tasks consisting of 25 questions:

- Mark "excellent" – 25-22 correct answers.
- Mark "good" – 22-18 correct answers.
- Mark "satisfactory" – 17-13 correct answers.
- Marked "unsatisfactory" – less than 13 correct answers

Knowledge criteria for the test:

- The "pass" grade must correspond to the parameters of any of the positive grades ("excellent", "good", "satisfactory").

- A "failed" grade must meet the parameters of an "unsatisfactory" grade.

- Mark "excellent" – all types of academic work provided for by the curriculum have been completed. The student demonstrates the correspondence of knowledge, skills and abilities to the indicators given in the tables, operates with acquired knowledge, skills and abilities, and applies them in situations of increased complexity. In this case, inaccuracies and difficulties may occur during analytical operations and the transfer of knowledge and skills to new, non-standard situations.

- Mark "good" – all types of educational work provided for by the curriculum have been completed. The student demonstrates the correspondence of knowledge, skills and abilities to the indicators given in the tables, operates with acquired knowledge, skills and abilities, and applies them in standard situations. In this case, minor errors, inaccuracies, and difficulties during analytical operations and the transfer of knowledge and skills to new, non-standard situations may be made.

- Mark "satisfactory" – one or more types of academic work provided for by the curriculum have not been completed. The student demonstrates incomplete compliance of knowledge, abilities, skills with the indicators given in the tables, significant mistakes are made, a partial lack of knowledge, abilities, and skills is manifested in a number of indicators, the

student experiences significant difficulties in operating knowledge and skills when transferring them to new situations. –

• Mark “unsatisfactory” – the types of educational work provided for by the curriculum have not been completed. Demonstrates incomplete compliance of knowledge, abilities, and skills with those given in the tables of indicators; significant mistakes are made; a lack of knowledge, abilities, and skills is evident in a larger number of indicators; the student experiences significant difficulties in operating knowledge and skills when transferring them to new situations

5. ACCESSIBILITY AND QUALITY OF EDUCATION FOR PERSONS WITH DISABILITIES

If necessary, disabled people and persons with limited health capabilities are given additional time to prepare an answer for the test.

When carrying out the procedure for assessing the learning outcomes of people with disabilities and people with limited health capabilities, their own technical means may be used.

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

For people with visual impairments:	– в печатной форме увеличенным шрифтом, – в форме электронного документа.
For people with hearing impairments:	– in printed form in enlarged font, – in the form of an electronic document.
For persons with musculoskeletal disorders	– in printed form, device: – in the form of an electronic document.

When carrying out the procedure for assessing the learning outcomes of disabled people and persons with limited health capabilities in the discipline, it ensures the fulfillment of the following additional requirements depending on the individual characteristics of the students:

a) instructions on the procedure for conducting the assessment procedure are provided in an accessible form (orally, in writing);

b) an accessible form for submitting assignments of assessment tools (in printed form, in printed form in enlarged font, in the form of an electronic document, assignments are read out by the teacher);

c) an accessible form of providing answers to assignments (written on paper, typing answers on a computer, orally).

If necessary, for students with disabilities and people with disabilities, the procedure for assessing learning outcomes in the discipline can be carried out in several stages.

The procedure for assessing the learning outcomes of disabled people and persons with limited health capabilities is permitted using distance learning technologies.