



MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE RUSSIAN FEDERATION
Federal State Autonomous Educational Institution of Higher Education

Far Eastern Federal University
(FEFU)

INSTITUTE OF LIFE SCIENCES AND BIOMEDICINE (SCHOOL)

AGREED

Head of Educational
Program

V.V. Kumeiko

(Signed) (Surname)

CLAIM

Director of the Production Company
Structural subdivision

V.V. Kumeiko

(Signed) (Surname)

April 12, 2023

WORK PROGRAM OF THE DISCIPLINE

Microbiology

Area of study 06.03.01 Biology

Form of training: full-time

The work program is drawn up in accordance with the requirements of the Federal State Educational Standard in the field of training 06.03.01 Biology, approved by the order of the Ministry of Education and Science of Russia dated 07.08.2020 No. 920

The work program was discussed at the meeting of the Department of Medical Biology and Biotechnology, Minutes No. 3 dated April 12, 2023.

Director of the Department of Medical Biology and Biotechnology V.V. Kumeiko

Compiled by: Ph.D. Kumeiko V.V.

Vladivostok
2022

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1. *The work program was revised at the meeting of the Department/Department/Division (implementing the discipline) and approved at the meeting of the Department/Department/Division (graduating structural unit), minutes of "*
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Abstract of the discipline

Microbiology

The total labor intensity of the discipline is 4 credit units / 144 academic hours. The curriculum provides for lectures in the amount of 18 hours, practical work in the amount of 36 hours, laboratory work in the amount of 36 hours, and also allocated hours for independent work of the student - 54 hours.

Language: Russian.

Objective: formation and development of general professional competencies necessary for professional activities in the field of industrial microbiology for the organization and implementation of cellular medical technologies in the field of biomedicine.

Tasks:

- 1) study of the basics of industrial microbiology, the laws underlying the technological processes of biotechnology;
- 2) study of existing biotechnological productions, their technical equipment, placement of technological equipment;
- 3) familiarization with the main stages of industrial production and with the management of the main stages of existing biotechnological productions;
- 4) familiarization with optimal and rational technological schemes;
- 5) study of scientific and technical information on the development of new directions in industrial biotechnology;
- 6) study of biotechnology objects and their biotechnological functions;
- 7) Study of biological systems used in molecular biotechnology.

For successful study of the discipline, students should have the following preliminary competencies:

- analyzes biochemical and molecular-biological mechanisms of the development of pathological processes in the cells and tissues of the human body and applies the principles of cellular organization of biological objects;

- understands the biochemical and molecular-biological mechanisms of the development of pathological processes in the cells and tissues of the human body;

- understands the principles of structural and functional organization of biological systems.

Competencies are obtained as a result of studying the disciplines of *general* biology, molecular and cell biology, *histology*, the student must be ready to study such disciplines as biomedical cell technologies, cell and tissue engineering, molecular modeling of biostructures that form competencies:

- uses fundamental knowledge and biophysical methods to diagnose pathological conditions;
- conducts fundamental and relevant research in molecular genetics, genetic and bioengineering, and molecular and biomedical technologies;

- applies the principles of obtaining and using enzymes, viruses, microorganisms, cell cultures of animals and plants, products of their biosynthesis.

General professional competence of students, indicators of their achievement and learning outcomes in the discipline

Code and name of general professional competence (result of mastering)	Code and name of the competency indicator
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OPK-1 Able to apply knowledge of biological diversity and use methods of observation, identification, classification, reproduction and cultivation of living objects to solve professional problems	OPK-1.1 Applies the theoretical foundations of molecular and cellular biology, microbiology and virology
	OPK-1.3 Applies methods of observation, identification, classification, reproduction and cultivation of living objects to solve professional problems
OPK-4 is able to carry out measures for the protection, use, monitoring and restoration of biological resources, using knowledge of the laws and methods of general and applied ecology	OPK-4.1 Applies knowledge of the basics of interaction of organisms with their environment, environmental factors and mechanisms of response of organisms, principles of population ecology, ecology of communities; Fundamentals of the organization and sustainability of ecosystems and the biosphere as a whole

Code and name of the competency indicator	Name of the assessment indicator (the result of learning in the discipline)
OPK-1.1 Applies the theoretical foundations of molecular and cellular biology, microbiology and virology	Knows Fundamentals of Molecular and Cellular Biology, Microbiology and Virology. Can apply the theoretical foundations of molecular and cellular biology, microbiology and virology. Owns ability to use the theoretical foundations of molecular and cellular biology, microbiology and virology
OPK-1.3 Applies methods of observation, identification, classification, reproduction and cultivation of living objects to solve professional problems	Knows methods of observation, identification, classification, reproduction and cultivation of living objects. Can apply methods of observation, identification, classification, reproduction and cultivation of living objects to solve professional problems. Owns methods of observation, identification, classification, reproduction and cultivation of living objects for solving professional problems.
OPK-4.1 Applies knowledge of the basics of interaction of organisms with their environment, environmental factors and mechanisms of response of organisms, principles of population ecology, ecology of communities; Fundamentals of the organization and sustainability of ecosystems and the biosphere as a whole	Knows the basics of interaction between organisms and their environment, environmental factors and mechanisms of organisms' responses, principles of population ecology, community ecology; the basics of the organization and stability of ecosystems and the biosphere as a whole. Can apply knowledge of the basics of interaction between organisms and their environment, environmental factors and mechanisms of organisms' responses, principles of population ecology, community ecology; Fundamentals of the organization and stability of ecosystems and the biosphere as a whole. Owns

Code and name of the competency indicator	Name of the assessment indicator (the result of learning in the discipline)
	skills of using knowledge of the basics of interaction of organisms with their environment, environmental factors and mechanisms of response of organisms, principles of population ecology, ecology of communities; the basics of the organization and stability of ecosystems and the biosphere as a whole

Professional Competencies, Indicators of Their Achievement and Learning Outcomes in the Discipline

Code and name of professional competence (result of mastering)	Code and name of the competency indicator
PC-7 Able to conduct microbiological, virological and epidemiological studies to solve professional problems in the field of biomedicine	PC-7.1 Possesses fundamental knowledge of the structure, vital activity, classification of microorganisms
	PC-7.2 Applies methods of virological, microbiological and epidemiological analysis
	PC-7.3 Understands the molecular features of the structure of microorganisms, the mechanisms of their interaction with cells and their role in pathological processes

Code and name of the competency indicator	Name of the assessment indicator (the result of learning in the discipline)
PC-7.1 Possesses fundamental knowledge of the structure, vital activity, classification of microorganisms	Knows features of the structure, vital activity, classification of viruses and microorganisms. Can apply knowledge about the peculiarities of the structure, vital activity, classification of viruses and microorganisms in professional activities. Owns skills of using knowledge about the features of the structure, vital activity, classification of viruses and microorganisms in professional activities.
PC-7.2 Applies methods of virological, microbiological and epidemiological analysis	Knows methods of virological, microbiological and epidemiological analysis. Can apply methods of virological, microbiological and epidemiological analysis. Owns methods of virological, microbiological and epidemiological analysis
PC-7.3 Understands the molecular features of the structure of microorganisms, the mechanisms of their interaction with cells and their role in pathological processes	Knows molecular features of the structure of viruses and microorganisms, knows the mechanisms of their interaction with cells and their role in pathological processes. Can apply knowledge about the molecular features of the structure of viruses and microorganisms, the mechanisms of their interaction with cells and their role in pathological processes. Owns

Code and name of the competency indicator	Name of the assessment indicator (the result of learning in the discipline)
	skills of using knowledge about the molecular features of the structure of viruses and microorganisms, the mechanisms of their interaction with cells and their role in pathological processes.

To form the above competencies within the discipline "Microbiology", the following educational technologies and methods of active/interactive learning are used: a business game, work in small groups, a round table.

I. Goals and objectives of mastering the discipline

Objective: formation and development of general professional competencies necessary for professional activities in the field of industrial microbiology for the organization and implementation of cellular medical technologies in the field of biomedicine.

Tasks:

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General professional competence of students, indicators of their achievement and learning outcomes in the discipline

Code and name of general professional competence (result of mastering)	Code and name of the competency indicator
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OPK-4 is able to carry out measures for the protection, use, monitoring and restoration of biological resources, using knowledge of the laws and methods of general and applied ecology	OPK-4.1 Applies knowledge of the basics of interaction of organisms with their environment, environmental factors and mechanisms of response of organisms, principles of population ecology, ecology of communities; Fundamentals of the organization and sustainability of ecosystems and the biosphere as a whole

Code and name of the competency indicator	Name of the assessment indicator (the result of learning in the discipline)
OPK-1.1 Applies the theoretical foundations of	Knows Fundamentals of Molecular and Cellular Biology, Microbiology and Virology.

Code and name of the competency indicator	Name of the assessment indicator (the result of learning in the discipline)
molecular and cellular biology, microbiology and virology	Can apply the theoretical foundations of molecular and cellular biology, microbiology and virology. Owns ability to use the theoretical foundations of molecular and cellular biology, microbiology and virology
OPK-1.3 Applies methods of observation, identification, classification, reproduction and cultivation of living objects to solve professional problems	Knows methods of observation, identification, classification, reproduction and cultivation of living objects. Can apply methods of observation, identification, classification, reproduction and cultivation of living objects to solve professional problems. Owns methods of observation, identification, classification, reproduction and cultivation of living objects for solving professional problems.
OPK-4.1 Applies knowledge of the basics of interaction of organisms with their environment, environmental factors and mechanisms of response of organisms, principles of population ecology, ecology of communities; Fundamentals of the organization and sustainability of ecosystems and the biosphere as a whole	Knows the basics of interaction between organisms and their environment, environmental factors and mechanisms of organisms' responses, principles of population ecology, community ecology; the basics of the organization and stability of ecosystems and the biosphere as a whole. Can apply knowledge of the basics of interaction between organisms and their environment, environmental factors and mechanisms of organisms' responses, principles of population ecology, community ecology; Fundamentals of the organization and stability of ecosystems and the biosphere as a whole. Owns skills of using knowledge of the basics of interaction of organisms with their environment, environmental factors and mechanisms of response of organisms, principles of population ecology, ecology of communities; the basics of the organization and stability of ecosystems and the biosphere as a whole

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II. Labor intensity of the discipline and types of training in the discipline

The total labor intensity of the discipline is 4 credit units (144 academic hours).

Types of training sessions and work of a student in the discipline can be:

Designation	Types of Study Sessions and Student Work
Mild	Lecture
Lab	Labs
Ave	Practical exercises
WED	Student's independent work during the period of theoretical training
Control	Independent work of the student and contact work of the student with the teacher during the period of intermediate certification

III. Structure of the discipline

The form of study is full-time.

№	Section Name Discipline	Semester	Number of hours by type of training and work of the student						Forms of intermediate certification, current monitoring of academic progress
			Mild	Lab	Ave	OK	WED	Control	
1	History of Industrial Microbiology	5	1	2	2	-	18	36	Exam Questions
2	General characteristics of microorganisms		2	4	4				
3	Basic Principles of Regulation of Metabolism and Growth Rate of Microorganisms		2	4	4				
4	Selection of microorganisms – producers of practically important substances		2	4	4				
5	Using Genetic Engineering to Produce Practically Useful Strains of Microorganisms		2	4	4				
6	Cultivation of microorganisms		2	4	4				
7	Aeration in the cultivation of microorganisms		2	4	4				
8	Storage of microorganisms		1	2	2				
9	Bacteriophages in the microbiological industry		2	4	4				
10	Immobilized Microbial Cells and Their Applications		2	4	4				
Total:		5	18	36	36	-	18	36	exam

IV. THE CONTENT OF THE THEORETICAL PART OF THE COURSE

Topic 1. History of Industrial Microbiology

- Chronological stages in the development of microbiology for biotechnology.
- Subject of industrial biotechnology.

Topic 2. General characteristics of microorganisms

- Aukaryotes (viruses and veroids).
- Prokaryotes (bacteria).
- Eukaryotes (fungi, algae, protozoa, higher plants, animals).
- Enzymes.

- Biologically active chemicals.
- Eukaryotic cell cultures.

Topic 3. Basic Principles of Regulation of Metabolism and Growth Rate of Microorganisms

- Concepts.
- Regulation at the level of protein biosynthesis.
- Regulation of the activity of ready-made protein messengers.
- Regulation of Integral Membrane Processes in Microorganisms.
- Interaction of regulatory mechanisms in controlling the growth rate of microorganisms.

Topic 4. Selection of microorganisms – producers of practically important substances

- Selection of the starting microorganism for selection.
- Preparation of the initial strain for breeding work.
- Getting mutants.
- Methods for selecting mutants with increased production levels.
- Method of obtaining genetic recombinants.

Topic 5. Using Genetic Engineering to Produce Practically Useful Strains of Microorganisms

- Production of human and animal proteins.
- Construction of strains producing primary and secondary metabolites.

Topic 6. Cultivation of microorganisms

- Batch cultivation is the beginning of the study of microbiological synthesis.
- Continuous cultivation of microorganisms.
- Quantitative characteristics of microorganisms.
- Controlled cultivation of microorganisms.

Topic 7. Aeration in the cultivation of microorganisms

– Effect of the concentration of dissolved oxygen in the medium on the growth of microorganisms.

– Transport of oxygen from the air to the culture medium and to microorganisms.

– Mathematical description of oxygen absorption in a periodically operating apparatus during the cultivation of microorganisms.

– Absorption of oxygen in a periodically operating apparatus without microorganisms.

– Absorption of oxygen in a periodically operating apparatus during cultivation and microorganisms.

– Absorption of oxygen in a continuously operating microbial culture apparatus.

Topic 8. Storage of microorganisms

- Periodic reseeded (or "sub-cultivation").
- Storage of microorganisms at low and ultra-low temperatures.
- Lyophilization.
- Storage of microorganisms in a dried state.
- Storage under mineral oil.
- Storage of individual groups of microorganisms.
- Determination of crop viability.

Topic 9. Bacteriophages in the microbiological industry

- Diversity and common properties of bacteriophages.
- Ingress of phages into production.
- Basic stages of development and the simplest methods of bacteriophage research.
 - Features of the development of moderate phages (lysogenization and induction).
 - Carriage (pseudolysogeny) and infection of cells by permanently developing phages (PRF infection).
 - Simple ways to identify bacteriophages.
 - Defective phages. The concept of essential and non-essential (additional) genes.
 - Principles and Methods of Bacteriophage Classification.
 - Phage profile of the plant.
 - Mechanisms of Bacterial Phage Resistance and Ways to Prevent Phagolysis.
 - Bacteriophages in Genetics and Selection of Industrial Producers.
 - General Biological Significance of Bacteriophage Research.

Topic 10. Immobilized Microbial Cells and Their Applications

- Methods of immobilization of microbial cells.
- Features of Living Immobilized Cells of Microorganisms.

V. CONTENT OF THE PRACTICAL PART OF THE COURSE AND INDEPENDENT WORK

Practical exercises

Class 1. Industrial Cultivation of Microorganisms

Class 2. Quantification of bacteria in different substrates

Class 3. Cultivation of aerobes and anaerobes

Class 4. Effect of Ultraviolet Rays on Microorganisms

Class 5. Effect of Temperature on Microorganisms

Class 6. Effect of antibiotics and phytoncides on microorganisms

Labs

Lab 1. Preparation of microbiological preparations. Methods for the study of organelles, structural elements and inclusions

Lab 2. Cultivation of microorganisms on nutrient media. Methods for isolating pure cultures of microorganisms

Lab 3. Preparation of nutrient mixture and matrix culture for yeast culture

Lab 4. Preparation of a fixed preparation

Lab 5. Preparation and analysis of culture liquid, culture media, seed material

Lab 6. Sanitary Microbiology

Self-paced work

Independent work includes:

- 1) library or homework with educational literature and lecture notes;
- 2) preparation for practical exercises;
- 3) work with microslides in the laboratory;
- 4) preparation for testing and control interviews;

The order of independent work by students is determined by the schedule of independent work in the discipline (see below)

Control of the results of independent work is carried out in the course of laboratory classes, oral surveys, interviews and tests, including by testing

Control questions and tasks for current control and intermediate certification based on the results of mastering the discipline follow from the thematic content of the discipline.

Students' independent work consists of preparing for practical classes, working on recommended literature, writing reports on the topic of the seminar, and preparing presentations.

The teacher offers each student individual and differentiated assignments. Some of them can be carried out in a group (for example, the preparation of a report and a presentation on the same topic can be done by several students with a division of their responsibilities - one prepares the scientific and theoretical part, and the second analyzes the practice).

Independent work can be carried out individually or by groups of students, depending on the purpose, volume, specific topic of independent work, level of complexity and level of skills of students.

Control of the results of students' independent work should be carried out within the time allotted for compulsory classes and extracurricular independent work of students in the discipline, can take place in written, oral or mixed form.

Self-Assessment Questions

1. What are the methods used to isolate the products of microbiological synthesis from the culture fluid if the target product is in solution?
2. What methods are used to isolate the products of microbiological synthesis from the culture fluid if the target product is in the solid phase?
3. What is biomass deposition and what is its rate?
4. What substances are used to accelerate biomass deposition?
10. What is Culture Liquid Extraction?
11. Why do the extractable components pass from the original solution to the solvent?
12. What is evaporation of culture liquid, its regimen, advantages and disadvantages?
13. What is the basis of membrane methods for separating liquid systems?
14. What are semi-permeable membranes made of and what are the requirements for them?
15. What methods of preserving biological preparations do you know?
16. What are the stages of freeze drying of biopreparats, and what are its advantages?
17. At what temperatures and for how long are freeze-dried biopreparations stored?
18. At what stage of sublimation is the moisture removed from the material, and at what stage is the knitted moisture removed, and what is the end of the first and second periods?

Sample Essay Topics

1. Adaptation of microorganisms to extreme environmental conditions.
2. Organization of genetic material in bacteria. Stability and variability of the bacterial genome.
3. Horizontal gene transfer in bacteria under laboratory and natural conditions.
4. Synthesis of ATP molecules in bacteria during aerobic growth on glucose media.
5. Synthesis of ATP molecules in bacteria under anaerobic conditions.
6. Growth and nutrition of microorganisms.
7. Chemical composition, organization and functions of the main structures of bacteria.
8. Antimicrobial substances of bacteria.
9. Diversity and systematics of bacteria.
10. Regulation of bacterial cell metabolism.
11. Bacterial restriction and modification system.
12. Assimilation of macro- and microelements.
13. Oxidation of inorganic compounds by chemolithotrophs.
14. Use of sunlight by prokaryotes
15. Relationships of microorganisms with animals.

16. Virulence factors of pathogenic bacteria for humans and animals.
17. Relationships of microorganisms with plants.
18. Virulence factors of phytopathogenic bacteria.
19. Biogeochemical activity of microorganisms.
20. Use of microorganisms in medicine, agriculture, industrial technologies.
21. Microorganisms and the environment.
22. Bacterial mutants and methods of their isolation.
23. Bacterial plasmids.
24. Migratory genetic elements of bacteria.
25. Bacteriophages: Particle Structure, Lytic Cycle, Lysogeny, Distribution and Practical Use.

VI. MONITORING THE ACHIEVEMENT OF THE COURSE OBJECTIVES

Item No.	Supervised modules/sections/topics of the discipline	Codes and Stages of Competency Formation		Valuation Tools – Name	
				Current control	Intermediate Attestation
1	Topic 1-3	OPK-1.1 Applies the theoretical foundations of molecular and cellular biology, microbiology and virology	Knows Fundamentals of Molecular and Cellular Biology, Microbiology and Virology. Can apply the theoretical foundations of molecular and cellular biology, microbiology and virology. Owns ability to use the theoretical foundations of molecular and cellular biology, microbiology and virology	Colloquium	Exam Questions

		OPK-1.3 Applies methods of observation, identification, classification, reproduction and cultivation of living objects to solve professional problems	<p>Knows methods of observation, identification, classification, reproduction and cultivation of living objects.</p> <p>Can apply methods of observation, identification, classification, reproduction and cultivation of living objects to solve professional problems.</p> <p>Owns methods of observation, identification, classification, reproduction and cultivation of living objects for solving professional problems.</p>		
2	Topic 4-6	OPK-4.1 Applies knowledge of the basics of interaction of organisms with their environment, environmental factors and mechanisms of response of organisms, principles of population ecology, ecology of communities; Fundamentals of the organization and sustainability of ecosystems and the biosphere as a whole	<p>Knows the basics of interaction between organisms and their environment, environmental factors and mechanisms of organisms' responses, principles of population ecology, community ecology; the basics of the organization and stability of ecosystems and the biosphere as a whole.</p> <p>Can apply knowledge of the basics of interaction between organisms and their environment, environmental factors and mechanisms of organisms' responses, principles of population ecology, community</p>	Colloquium	Exam Questions

			<p>ecology; Fundamentals of the organization and stability of ecosystems and the biosphere as a whole.</p> <p>Owns skills of using knowledge of the basics of interaction of organisms with their environment, environmental factors and mechanisms of response of organisms, principles of population ecology, ecology of communities; the basics of the organization and stability of ecosystems and the biosphere as a whole</p>		
		<p>PC-7.1 Possesses fundamental knowledge of the structure, vital activity, classification of microorganisms</p>	<p>Knows features of the structure, vital activity, classification of viruses and microorganisms.</p> <p>Can apply knowledge about the peculiarities of the structure, vital activity, classification of viruses and microorganisms in professional activities.</p> <p>Owns skills of using knowledge about the features of the structure, vital activity, classification of viruses and microorganisms in professional activities.</p>		
3	Topic 7-10	<p>PC-7.2 Applies methods of virological, microbiological</p>	<p>Knows methods of virological, microbiological and</p>	Test	Exam Questions

		<p>and epidemiological analysis</p>	<p>epidemiological analysis. Can apply methods of virological, microbiological and epidemiological analysis. Owns methods of virological, microbiological and epidemiological analysis</p>		
		<p>PC-7.3 Understands the molecular features of the structure of microorganisms, the mechanisms of their interaction with cells and their role in pathological processes</p>	<p>Knows molecular features of the structure of viruses and microorganisms, knows the mechanisms of their interaction with cells and their role in pathological processes. Can apply knowledge about the molecular features of the structure of viruses and microorganisms, the mechanisms of their interaction with cells and their role in pathological processes. Owns skills of using knowledge about the molecular features of the structure of viruses and microorganisms, the mechanisms of their interaction with cells and their role in pathological processes.</p>	<p>Test</p>	

VII. EDUCATIONAL AND METHODOLOGICAL SUPPORT OF STUDENTS' INDEPENDENT WORK

Guidelines for writing and formatting an abstract

Abstracting of educational and scientific literature involves an in-depth study of individual scientific works, which should ensure the development of the necessary skills for working on the book. All this will contribute to the expansion of scientific horizons, the improvement of their theoretical training, and the formation of scientific competence.

Textbooks, individual monographic studies and articles on issues provided for by the program of the academic discipline are offered for abstracting. When selecting literature on the chosen issue, it is necessary to cover the most important areas of development of this science at the present stage. Particular attention should be paid to those literary sources that (directly or indirectly) can help the specialist in his practical activities. However, this section also includes works and individual studies on issues that go beyond the discipline being studied. It is recommended to use this literature if you want to expand your knowledge in any branch of science.

Along with literature on general issues, students are supposed to read literature taking into account the profile of their professional activity, obtained independently. Not all the proposed literature is equal in content and volume, so different approaches to its study are possible. In one case, it can be a general abstract of several literary sources of different authors devoted to the consideration of the same issue, in the other case, it can be a detailed study and abstract of one of the recommended works or even its separate sections, depending on the degree of complexity of the issue (problematic). In order to decide what to do in each case, you should consult with the teacher.

The choice of a specific work for the abstract should be preceded by a detailed acquaintance with the list of all literature given in the curriculum of the discipline. It is recommended to first familiarize yourself with the selected work by looking at the subheadings, highlighted texts, diagrams, tables, and general conclusions. Then it is necessary to read it carefully and thoughtfully (delving into the ideas and methods of the author), making notes on a separate sheet of paper about the main provisions and key issues. After reading, you should think over the content of the article or a separate chapter, paragraph (if we are talking about a monograph) and briefly write it down. Only strict definitions and formulations of laws should be written out verbatim. Sometimes it's helpful to include one or two examples to illustrate. In the event that there are unclear passages, it is recommended to read the following exposition, as it can help to understand the previous material, and then return to the comprehension of the previous exposition.

The result of the work on literary sources is an abstract.

When preparing an abstract, it is necessary to highlight the most important theoretical provisions and substantiate them independently, paying attention not only to the result, but also to the methodology used in the study of the problem. Reading scientific literature should be critical. Therefore, it is necessary to strive not only to assimilate the main content, but also the method of proof, to reveal the features of different points of view on the same issue, to assess the practical and theoretical significance of the results of the reviewed work. A very desirable element of the abstract is the expression by the listener of his own attitude to the ideas and conclusions of the author, supported by certain arguments (personal experience, statements of other researchers, etc.).

As mentioned above, abstracts of monographs and journal articles of a research nature must contain a definition of the problem and specific objectives of the research, a description of the methods used by the author, as well as the conclusions that he came to as a result of the research. The proposed literature for abstracting is constantly updated.

Instructions for writing essays:

General requirements for the abstract:

The abstract should be written according to the standard scheme, including:

- Title page
- contents
- introduction
- Main part
- Conclusion of the E
- List of references.

It is desirable to include tables and (or) figures in the text of the abstract: diagrams, graphs. The volume of the abstract: 10-20 pages of A4 format computer layout in the Times New Roman editor, with 1.5 intervals, in 14 fonts. The title of the topic of the essay should fully correspond to the chosen option.

The structure of the abstract should meet the standard requirements for writing essays: introduction, justification for the choice of topic, presentation of the topic, conclusion. More detailed requirements for the written design of the abstract are presented in the Procedure "Requirements for the design of written works performed by FEFU students and attendees" http://law.wl.dvgu.ru/docs/treb_2012.pdf

Approximate list of abstract topics:

1. Mechanisms of energy production in mitochondria.
2. The liver is its role for the human body.
3. Alcoholism and drug addiction are metabolic disorders.
4. Influence of trace elements on enzyme activity.
5. Metabolic connections of the Krebs cycle.
6. Types of jaundice.

7. Biotransformation of xenobiotics in the body.
8. Cholesterol fund in the human body and ways of its consumption.
9. Biological role of iron, molybdenum and zinc.

Criteria and Indicators Used in the Evaluation of the Educational Essay

Criteria	Indicators
1. Novelty of the abstracted text Max. - 5 points	- relevance of the problem and topic;- novelty and independence in the formulation of the problem, in the formulation of a new aspect of the problem selected for analysis;- the presence of the author's position, independence of judgments.
2. Degree of disclosure of the essence of the problem Max. - 5 points	- correspondence of the plan to the topic of the abstract;- correspondence of the content to the topic and plan of the abstract;- completeness and depth of disclosure of the main concepts of the problem;- validity of ways and methods of working with the material;- ability to work with literature, systematize and structure the material;- ability to generalize, compare different points of view on the issue under consideration, argue the main provisions and conclusions.
3. Reasonableness of the choice of sources Max. - 5 points	- the range and completeness of the use of literary sources on the problem;- attraction of the latest works on the problem (journal publications, materials of collections of scientific papers, etc.).
4. Compliance with Registration Requirements Max. - 5 points	- correct formatting of references to the literature used;- literacy and culture of presentation;- knowledge of terminology and conceptual apparatus of the problem;- compliance with the requirements for the volume of the abstract;- culture of design: highlighting paragraphs.
5. Literacy Max. - 5 points	- absence of spelling and syntax errors, stylistic errors;- absence of typos, abbreviations of words, except for generally accepted ones;- literary style.

Guidelines for Maintenance, Submission Requirements and Criteria for Evaluating the Outline

A synopsis (from the Latin conspectus – review) is a written text in which the content of the main source of information is briefly and consistently stated. To take notes is to bring to some order the information gleaned from the original. The process is based on the systematization of what has been read or heard. Notes can be made both in the form of precise excerpts, quotations, and in the form of a free presentation of meaning. The manner of writing the synopsis, as a rule, is close to the style of the original source. If the synopsis is written correctly, it should reflect the logic and semantic connection of the information being recorded.

In well-made notes, it is easy to find specialized terminology that is clearly explained and clearly highlighted for memorizing the meanings of various words. Using the outline information, it is easier to create meaningful creative or scientific works, various essays and articles.

Note-taking rules

1. Read the text carefully. Along the way, mark incomprehensible places, new words, names, dates.

2. Make inquiries about the persons and events mentioned in the text. When recording, do not forget to put reference data in the fields.

3. When reading the text for the first time, make a simple outline. When re-reading, try to summarize the main points of the text, noting the author's arguments.

4. The final stage of note-taking consists of re-reading the previously marked passages and writing them down consecutively.

5. When taking notes, you should try to express the author's thought in your own words.

6. Strive to ensure that one paragraph of the author's text is conveyed in one, maximum two sentences.

When taking notes of lectures, it is recommended to adhere to the following basic rules.

1. Do not start writing down the material from the first words of the teacher, first listen to his thought to the end and try to understand it.

2. Start writing at the moment when the teacher, having finished the presentation of one idea, begins to comment on it.

3. In the synopsis, it is necessary to highlight individual parts. It is necessary to distinguish between headings, subheadings, conclusions, to separate one topic from another. Selection can be done with an underline or a different color (just don't turn the text into colorful pictures). It is recommended to indent paragraphs and points of the plan, white lines to separate one thought from another, and numbering. If definitions, formulas, rules, and laws can be made more visible in the text, they are framed. Over time, you'll have your own selection system.

4. Create your entries using accepted conventions. When taking notes, be sure to use a variety of signs (they are called signal signs). These can be pointers and directional arrows, exclamation and question marks, combinations PS (afterword) and NB (pay attention). For example, you can denote the word "therefore" with a mathematical arrow \Rightarrow . Once you've developed your own character set, it's easier and faster to create an outline and then study it.

5. Don't forget about abbreviations (abbreviated words), equal and inequality signs, more and less.

6. Abbreviations are very useful for creating a correct outline. Be careful, though. Connoisseurs believe that abbreviations such as "d-t" (to think) and similar ones should not be used, since later a large amount of time is spent on deciphering, and after all, the reading of the synopsis should not be interrupted by extraneous actions and reflections. The best thing to do is to develop your own system of abbreviations and use them to denote the same words (and nothing else) in all entries. For example, the abbreviation

"g-t" will always and everywhere be the word "to speak," and the capital "P" will be the word "work."

7. Undoubtedly, foreign words will help to organize a good synopsis. The most common among them are English. For example, the abbreviated "ok" successfully denotes the words "excellent", "wonderful", "good".

8. Complex and lengthy reasoning should be avoided.

9. When taking notes, it is better to use declarative sentences, avoid independent questions. Questions are appropriate in the margins of the outline.

10. Do not try to record the material verbatim, in this case the main idea is often lost, and it is difficult to keep such a record. Discard secondary words, without which the main idea is not lost.

11. If there are terms in the lecture that you do not understand, leave a place, clarify their meaning with the teacher after the lesson.

Evaluation criteria:

86-100 points are given to the student if the abstract is presented in the most understandable form, has a plan, schemes and drawings in the structure, reveals all the basic concepts and questions given above;

76-85 points are given to the student if the abstract is presented in a sufficiently understandable form, has schemes and/or drawings in the structure, reveals more than half of the main concepts and questions;

75-61 points are given to the student if the abstract is presented in a relatively understandable form and reveals half of the main concepts and questions;

60-50 points are given to the student if the outline is presented in an incomprehensible form and reveals less than half of the main concepts and questions.

VIII. LIST OF EDUCATIONAL LITERATURE AND INFORMATIONAL AND METHODOLOGICAL SUPPORT OF THE DISCIPLINE

Reference citations

1. Yemtsev, V. T. Microbiology: textbook for higher education institutions / V. T. Yemtsev, E. N. Mishustin. — 8th ed., ispr. i dop. — Moscow: Yurayt Publishing House, 2023. — 428 p. — (Higher education). — ISBN 978-5-534-06081-2. — Text : electronic // Educational platform Urait [site]. — URL: <https://urait.ru/bcode/510779>

2. Netrusov, A. I. Microbiology: Theory and Practice in 2 Parts Part 1 : Textbook for Higher Educational Institutions / A. I. Netrusov, I. B. Kotova. - Moscow: Yurayt Publishing House, 2023. — 315 p. — (Higher education). — ISBN 978-5-534-03805-7. — Text : electronic // Educational platform Urait [site]. — URL: <https://urait.ru/bcode/510995>

3. Microbiology: Pathogens of Bacterial Airborne Infections: Textbook for Higher Educational Institutions / L. I. Kafarskaya [i dr.] ; edited by L. I. Kafarskaya. - 4th ed. - Moscow: Yurayt Publishing House, 2022. — 115 p. — (Higher education). — ISBN 978-5-534-13081-2. — Text : electronic // Educational platform Urait [site]. — URL: <https://urait.ru/bcode/496315>

4. Netrusov, A. I. Microbiology: Theory and Practice in 2 Parts Part 2 : Textbook for Higher Educational Institutions / A. I. Netrusov, I. B. Kotova. - Moscow: Yurayt Publishing House, 2023. — 332 p. — (Higher education). — ISBN 978-5-534-03806-4. — Text : electronic // Educational platform Urait [site]. — URL: <https://urait.ru/bcode/512707>

5. Maltsev, V. N. Fundamentals of Microbiology and Immunology: Textbook for Secondary Professional Education / V. N. Maltsev, E. P. Pashkov, L. I. Khaustova. - 2nd ed., ispr. i dop. — Moscow: Yurayt Publishing House, 2023. — 319 p. — (Professional education). — ISBN 978-5-534-11566-6. — Text : electronic // Educational platform Urait [site]. — URL: <https://urait.ru/bcode/518091>

Further reading

1. Ilyashenko N.G., Shaburova L.N. Microorganisms and Environment: Textbook for Higher Educational Institutions / N.G. Ilyashenko, L.N. Shaburova // Moscow, Infra-M. – 2017. 194 p. (in Russian). Mode of access: <http://lib.dvfu.ru:8080/lib/item?id=chamo:841875&theme=FEFU>

2. Sidorenko O.D., Borisenko E.G. Microbiology: textbook for higher education institutions // Moscow, Infra-M. – 2016. 286 p. (in Russian). Mode of access: <http://lib.dvfu.ru:8080/lib/item?id=chamo:809012&theme=FEFU>

3. Netrusov, A.I. Ecology of microorganisms: textbook for bachelors in biological specialties // A.I. Netrusov, V.M. Gorlenko // Moscow, "Yurayt". – 2016. 267 p. (in Russian). Mode of access: <http://lib.dvfu.ru:8080/lib/item?id=chamo:820092&theme=FEFU>

4. Ksenofontov B.S. Osnovy mikrobiologii i ekologicheskogo biotekhnologii: uchebnoe posobie dlya vuzov [Fundamentals of microbiology and ecological biotechnology: a textbook for higher education institutions] / B.S. Ksenofontov // Moscow, Infra-M. – 2015. 220 p. (in Russian). Mode of access: <http://lib.dvfu.ru:8080/lib/item?id=chamo:795548&theme=FEFU>

5. Kamysheva K.S. Osnovy mikrobiologii i immunologii: uchebnoe posobie dlya srednego professional'nogo obrazovaniya [Fundamentals of microbiology and immunology: a textbook for secondary professional education] / K.S. Kamysheva // Rostov-on-Don, "Phoenix". – 2016. 382 p. (in Russian). Available at: <http://lib.dvfu.ru:8080/lib/item?id=chamo:823578&theme=FEFU>

6. Ivchatov A.L. Microbiology / A. L. Ivchatov. Moscow: Association of Construction Universities Publ., 2013. – 118 p.

<https://lib.dvfu.ru/lib/item?id=chamo:864427&theme=FEFU>

7. Sakharova O.V., Sakharova T.G. Obshchaya mikrobiologiya i obshchaya sanitarnaya mikrobiologiya [General microbiology and general sanitary microbiology: textbook]. St. Petersburg: Lan, 2019. 223 p. (in Russian).
<https://lib.dvfu.ru/lib/item?id=chamo:881725&theme=FEFU>

List of resources of the information and telecommunication network "Internet"

1. <http://elibrary.ru/> - Scientific Electronic Library
2. <http://molbiol.ru/> - Molecular Biology Information Resource
3. <http://macroevolution.narod.ru/> is an electronic resource on evolutionary biology.
4. <http://science.km.ru/> - electronic resource on different sections of biology
5. <http://elementy.ru/> is an informational and educational resource dedicated to natural sciences.
6. <http://www.iprbookshop.ru/> is the IPRbooks electronic library system.
7. <http://znanium.com/> - EBS "Znanium".
8. <https://nplus1.ru/> - N+1, a popular science online publication about science, engineering and technology
9. <http://antropogenez.ru/> is a popular science information resource about human evolution
10. <http://web.a.ebscohost.com/ehost/search/basic?sid=851485f8-6200-4b3e-aaab-df4ba7be3576@sessionmgr4008&vid=1&tid=2003EB> is a collection of books on various sections from the EBSCOhost database.
11. <http://rosalind.info/problems/locations/> - resource for self-study of bioinformatics Rosalind.
12. <http://www.ncbi.nlm.nih.gov/> website of the - National Center for Biotechnology Information (NCBI).
13. <http://www.mendeley.com/> - Mendeley: Free reference manager and PDF organizer; Librarian Program.
14. <http://www.ebi.ac.uk/> - website of the European Bioinformatics Institute
15. <http://www.scopus.com> – Scopus bibliographic database and citation index
16. <http://thomsonreuters.com/thomson-reuters-web-of-science/> Web of Science bibliographic database and citation index

List of information technologies and software

1. Microsoft Office Professional Plus 2013 is an office suite that includes software for working with various types of documents (texts, spreadsheets, databases, etc.);
2. 7Zip 16.04 - free file archiver with high data compression ratio;

3. Adobe Acrobat XI Pro is a software package for creating and viewing electronic publications in PDF format;
4. AutoCAD Electrical 2015 - three-dimensional computer-aided design and drafting system;
5. ESET Endpoint Security 5 is a comprehensive protection solution for Windows-based workstations. Virtualization support + new technologies;
6. WinDjView 2.0.2 is a program for recognizing and viewing files with the same DJV and DjVu formats; SolidWorks 2016 is a CAD software package for automating the work of an industrial enterprise at the stages of design and technological preparation of production
7. Compass-3D LT V12 - Three-Dimensional Simulation System
8. Notepad++ 6.68 – Text Editor

IX. METHODOICAL INSTRUCTIONS FOR MASTERING THE DISCIPLINE

Guidelines for writing and formatting an abstract

Abstracting of educational and scientific literature involves an in-depth study of individual scientific works, which should ensure the development of the necessary skills for working on the book. All this will contribute to the expansion of scientific horizons, the improvement of their theoretical training, and the formation of scientific competence.

Textbooks, individual monographic studies and articles on issues provided for by the program of the academic discipline are offered for abstracting. When selecting literature on the chosen issue, it is necessary to cover the most important areas of development of this science at the present stage. Particular attention should be paid to those literary sources that (directly or indirectly) can help the specialist in his practical activities. However, this section also includes works and individual studies on issues that go beyond the discipline being studied. It is recommended to use this literature if you want to expand your knowledge in any branch of science.

Along with literature on general issues, students are supposed to read literature taking into account the profile of their professional activity, obtained independently. Not all the proposed literature is equal in content and volume, so different approaches to its study are possible. In one case, it can be a general abstract of several literary sources of different authors devoted to the consideration of the same issue, in the other case, it can be a detailed study and abstract of one of the recommended works or even its individual sections, depending on the degree of complexity of the issue (problematic). In order to decide what to do in each case, you should consult with the teacher.

The choice of a specific work for the abstract should be preceded by a detailed acquaintance with the list of all literature given in the curriculum of the discipline. It is

recommended to first familiarize yourself with the selected work by looking at the subheadings, highlighted texts, diagrams, tables, and general conclusions. Then it is necessary to read it carefully and thoughtfully (delving into the ideas and methods of the author), making notes on a separate sheet of paper about the main provisions and key issues. After reading, you should think over the content of the article or a separate chapter, paragraph (if we are talking about a monograph) and briefly write it down. Only strict definitions and formulations of laws should be written out verbatim. Sometimes it's helpful to include one or two examples to illustrate. In the event that there are unclear passages, it is recommended to read the following exposition, as it can help to understand the previous material, and then return to the comprehension of the previous exposition.

The result of the work on literary sources is an abstract.

When preparing an abstract, it is necessary to highlight the most important theoretical provisions and substantiate them independently, paying attention not only to the result, but also to the methodology used in the study of the problem. Reading scientific literature should be critical. Therefore, it is necessary to strive not only to assimilate the main content, but also the method of proof, to reveal the features of different points of view on the same issue, to assess the practical and theoretical significance of the results of the reviewed work. A very desirable element of the abstract is the expression by the listener of his own attitude to the ideas and conclusions of the author, supported by certain arguments (personal experience, statements of other researchers, etc.).

As mentioned above, abstracts of monographs and journal articles of a research nature must contain a definition of the problem and specific objectives of the research, a description of the methods used by the author, as well as the conclusions that he came to as a result of the research. The proposed literature for abstracting is constantly updated.

Instructions for writing essays:

General requirements for the abstract:

The abstract should be written according to the standard scheme, including:

- Title page
- contents
- introduction
- Main part
- conclusion
- List of references.

It is desirable to include tables and (or) figures in the text of the abstract: diagrams, graphs. The volume of the abstract: 10-20 pages of A4 format computer layout in the Times New Roman editor, with 1.5 intervals, in 14 fonts. The title of the topic of the essay should fully correspond to the chosen option.

The structure of the abstract should meet the standard requirements for writing essays: introduction, justification for the choice of topic, presentation of the topic, conclusion. More detailed requirements for the written design of the abstract are presented in the Procedure "Requirements for the design of written works performed by FEFU students and listeners" http://law.wl.dvgu.ru/docs/treb_2012.pdf

Approximate list of abstract topics:

1. Mechanisms of energy production in mitochondria.
2. The liver is its role in the human body.
3. Alcoholism and drug addiction are metabolic disorders.
4. Influence of trace elements on enzyme activity.
5. Metabolic connections of the Krebs cycle.
6. Types of jaundice.
7. Biotransformation of xenobiotics in the body.
8. Cholesterol fund in the human body and ways of its consumption.
9. Biological role of iron, molybdenum and zinc.

Criteria and Indicators Used in the Evaluation of the Educational Essay

Criteria	Indicators
1. Novelty of the abstracted text Max. – 5 points	- relevance of the problem and topic;- novelty and independence in the formulation of the problem, in the formulation of a new aspect of the problem selected for analysis;- the presence of the author's position, independence of judgments.
2. Degree of disclosure of the essence of the problem Max. – 5 points	- correspondence of the plan to the topic of the abstract;- correspondence of the content to the topic and plan of the abstract;- completeness and depth of disclosure of the main concepts of the problem;- validity of ways and methods of working with the material;- ability to work with literature, systematize and structure the material;- ability to generalize, compare different points of view on the issue under consideration, argue the main provisions and conclusions.
3. Reasonableness of the choice of sources Max. – 5 points	- the range and completeness of the use of literary sources on the problem;- attraction of the latest works on the problem (journal publications, materials of collections of scientific papers, etc.).
4. Compliance with Registration Requirements Max. – 5 points	- correct formatting of references to the literature used;- literacy and culture of presentation;- knowledge of terminology and conceptual apparatus of the problem;- compliance with the requirements for the volume of the abstract;- culture of design: highlighting paragraphs.

5. Literacy Max. - 5 points	- absence of spelling and syntax errors, stylistic errors;- absence of typos, abbreviations of words, except for generally accepted ones;- literary style.
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Guidelines for Maintenance, Submission Requirements and Criteria for Evaluating the Outline

A synopsis (from the Latin *conspicere* – review) is a written text in which the content of the main source of information is briefly and consistently stated. To take notes is to bring to some order the information gleaned from the original. The process is based on the systematization of what has been read or heard. Notes can be made both in the form of precise excerpts, quotations, and in the form of a free presentation of meaning. The manner of writing the synopsis, as a rule, is close to the style of the original source. If the synopsis is written correctly, it should reflect the logic and semantic connection of the information being recorded.

In well-made notes, it is easy to find specialized terminology that is clearly explained and clearly highlighted for memorizing the meanings of various words. Using the outline information, it is easier to create meaningful creative or scientific works, various essays and articles.

Note-taking rules

1. Read the text carefully. Along the way, mark incomprehensible places, new words, names, dates.
2. Make inquiries about the persons and events mentioned in the text. When recording, do not forget to put reference data in the fields.
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4. The final stage of note-taking consists of re-reading the previously marked passages and writing them down consecutively.
5. When taking notes, you should try to express the author's thought in your own words.
6. Strive to ensure that one paragraph of the author's text is conveyed in one, maximum two sentences.

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1. Do not start writing down the material from the first words of the teacher, first listen to his thought to the end and try to understand it.
2. Start writing at the moment when the teacher, having finished the presentation of one idea, begins to comment on it.
3. In the synopsis, it is necessary to highlight individual parts. It is necessary to distinguish between headings, subheadings, conclusions, to separate one topic from another. Selection can be done with an underline or a different color (just don't turn the

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5. Don't forget about abbreviations (abbreviated words), equal and inequality signs, more and less.

6. Abbreviations are very useful for creating a correct outline. Be careful, though. Connoisseurs believe that abbreviations such as "d-t" (to think) and similar ones should not be used, since later a large amount of time is spent on deciphering, and after all, the reading of the synopsis should not be interrupted by extraneous actions and reflections. The best thing to do is to develop your own system of abbreviations and use them to denote the same words (and nothing else) in all entries. For example, the abbreviation "g-t" will always and everywhere be the word "to speak," and the capital "P" will be the word "work."

7. Undoubtedly, foreign words will help to organize a good synopsis. The most common among them are English. For example, the abbreviated "ok" successfully denotes the words "excellent", "wonderful", "good".

8. Complex and lengthy reasoning should be avoided.

9. When taking notes, it is better to use declarative sentences, avoid independent questions. Questions are appropriate in the margins of the outline.

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11. If there are terms in the lecture that you do not understand, leave a place, clarify their meaning with the teacher after the lesson.

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60-50 points are given to the student if the outline is presented in an incomprehensible form and reveals less than half of the main concepts and questions.

MATERIAL AND TECHNICAL SUPPORT OF DISCIPLINE

Logistical and software of the discipline

Name of special rooms and rooms for independent work	Equipment of special rooms and rooms for independent work	List of licensed software. Details of the supporting document
<p>Lecture hall: 690922, Primorsky Krai, Vladivostok, Russky Island, Saperny Peninsula, Ajax village, 10, aud. M 421</p>	<p>DLP projector, 3000 ANSI Lm, WXGA 1280x800, 2000:1 EW330U Mitsubishi; CORSA-2007 Tuarex Specialized Equipment Fastening Subsystem; Video Switching Subsystem: Extron DXP 44 DVI Pro DVI Matrix Switcher; Extron DVI 201 Tx/Rx twisted-pair DVI extender Audio switching and sound amplification subsystem; Extron SI 3CT LP Ceiling Mount Speaker System Extron DMP 44 LC Digital Audio Processor; extension for IPL T CR48 control controller.</p>	<p>Windows Seven Enterprise SP3x64 (Microsoft License Number Standard Enrollment 62820593. End date: 2020-06-30. Campus 3 Parent Program 49231495. Reseller: JSC "Softline Trade" Reseller Order Number: Tr000270647-18.) Eset NOD32 Antivirus 4.2.76.1 (Contract No. EA-091-18 dated 24.04.2018. Microsoft Office 2010 Professional Plus 14.0.6029.1000 (Microsoft License Number Standard Enrollment 62820593. End Date 2020-06-30. Parent Program Campus 3 49231495. Reseller: JSC "Softline Trade" Reseller Order Number: Tr000270647-18.) Microsoft Office Professional Plus 2013 15.0.4420.1017 (Microsoft License Number Standard Enrollment 62820593. End Date 2020-06-30. Parent Program Campus 3 49231495. Reseller: JSC "Softline Trade" Reseller Order Number: Tr000270647-18.) Google Chrome 42.0.2311.90 (Free Software)</p>
<p>Computer class of the School of Biomedicine aud. M723, 15 workplaces</p>	<p>Electric Screen 236*147cm Trim Screen Line; DLP projector, 3000 ANSI Lm, WXGA 1280x800, 2000:1 EW330U Mitsubishi; CORSA-2007 Tuarex Specialized Equipment Fastening Subsystem; Video Switching Subsystem: Extron DXP 44 DVI Pro DVI Matrix Switcher; Extron DVI 201</p>	<p>Microsoft Office Professional Plus 2013 is an office suite that includes software for working with various types of documents (texts, spreadsheets, databases, etc.); 7Zip 16.04 - free file archiver with high data compression ratio; Adobe Acrobat XI Pro is a software package for creating and viewing electronic publications in PDF format;</p>

	<p>Tx/Rx twisted-pair DVI extender Audio switching and sound amplification subsystem; Extron SI 3CT LP Ceiling Mount Speaker System Extron DMP 44 LC Digital Audio Processor; extension for IPL T CR48 control controller; Wireless LAN for students is provided by a system based on 802.11a/b/g/n 2x2 MIMO(2SS) access points. Моноблок HP ProOne 400 All-in-One 19.5 (1600x900), Core i3-4150T, 4GB DDR3-1600 (1x4GB), 1TB HDD 7200 SATA, DVD+/-RW, GigEth, Wi-Fi, BT, usb kbd/mse, Win7Pro (64-bit)+Win8.1Pro(64-bit), 1-1-1 Wty</p>	<p>AutoCAD Electrical 2015 - three-dimensional computer-aided design and drafting system; ESET Endpoint Security 5 is a comprehensive protection solution for Windows-based workstations. Virtualization support + new technologies; WinDjView 2.0.2 is a program for recognizing and viewing files with the same DJV and DjVu formats; SolidWorks 2016 is a CAD software package for automating the work of an industrial enterprise at the stages of design and technological preparation of production Compass-3D LT V12 - Three-Dimensional Simulation System Notepad++ 6.68 – Text Editor</p>
<p>Classrooms for self-study: Reading rooms of the FEFU Scientific Library with open access to the collection (building A - level 10)</p>	<p>HP RgoOpe 400 All-in-One 19.5 (1600x900), Core i3-4150T, 4GB DDR3-1600 (1x4GB), 1TB HDD 7200 SATA, DVD+/-RW, GigEth, Wi-Fi, VT, usb kbd/mse, Win7Pro (64-bit)+Win8.1Pro(64-bit), 1-1-1 Wty Internet access speed 500 Mbps. Workplaces for people with disabilities are equipped with displays and Braille printers; equipped with: portable devices for reading flat-printed texts, scanning and reading machines, a video magnifier with the ability to adjust color spectrums; magnifying electronic magnifiers and ultrasonic markers.</p>	<p>Windows Seven Enterprise SP3x64 (Microsoft License Number Standard Enrollment 62820593. End date: 2020-06-30. Campus 3 Parent Program 49231495. Reseller: JSC "Softline Trade" Reseller Order Number: Tr000270647-18.) Eset NOD32 Antivirus 4.2.76.1 (Contract No. EA-091-18 dated 24.04.2018. Microsoft Office 2010 Professional Plus 14.0.6029.1000 (Microsoft License Number Standard Enrollment 62820593. End Date 2020-06-30. Parent Program Campus 3 49231495. Reseller: JSC "Softline Trade" Reseller Order Number: Tr000270647-18.) Microsoft Office Professional Plus 2013 15.0.4420.1017 (Microsoft License Number Standard Enrollment 62820593. End Date 2020-06-30. Parent Program Campus 3 49231495. Reseller: JSC "Softline Trade" Reseller Order Number: Tr000270647-18.) Google Chrome 42.0.2311.90 (Free Software)</p>

<p>Classrooms for practical and laboratory work: 690922, Primorsky Krai, Vladivostok, Russky Island, Saperny Peninsula, Ajax village, 10, aud. M 432, 431</p>	<p>Laboratory of Biochemistry: Dry-air thermostat MIR-262; Pioneer Precision Scales (PA413); Laboratory centrifuge LMC-4200R; MSH-300i Magnetic Stirrer with Thermal Regulation; Distiller GFL-2008; Electric stove Mechta 111H; Spectrophotometer with BioSpectrometer-kinetic Sample Processing Accessories Mkmed-5 medical microscope, Hematology Analyzer XP-300 Panchenkov's apparatus Goryaev's Chamber Laboratory counter S-5 DocUReader 2 Pro Urine Analyzer Photometer KFK-Z-01— "ZOMZ" photovoltaic Wash StatFax 2600 Shaker Thermostat ST-3M Medical Photometers for iMark microplates</p>	
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