**MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE RUSSIAN FEDERATION**
Federal State Budgetary Educational Institution of Higher Education
**"IRKUTSK STATE UNIVERSITY"**
**SAF, Baikal International Business School (Institute)**
Strategic and Financial Management Department

APPROVED:
Dean of SAF, Baikal International Business School (institute)
_____ N.B. Grosheva
April 14, 2025

# Syllabus

Discipline Б1.О.22 Ecology

Major 27.03.05 Innovatics

Specialization: Management of Innovative and IT Projects and Products

University Degree: Bachelor

Full time

Approved by the Academic and Methodological Council of Baikal International Business School (institute)
Protocol № 4 March 26, 2025

Chairperson V.M. Maksimova

Recommended by the Strategic and Financial Management Department
Protocol № 9 March 21, 2025

Department Chair N.B. Grosheva

Irkutsk 2025

Content

## I. GOALS AND OBJECTIVES OF THE DISCIPLINE (MODULE)

**Objectives:** To teach the fundamentals of ecology—a comprehensive, interdisciplinary science that synthesizes data from the natural and social sciences on nature and its interactions with society—and to foster environmental thinking, a high level of environmental awareness, and a desire to manage natural resources sustainably. **Course objectives:** Students should become familiar with and master:

- basic terms, concepts and laws of ecology;
- gain an understanding of living systems of varying degrees of complexity in their interactions with each other and with the environment;
- learn to work with specialized literature, prepare essays, and present reports on environmental topics

## II. THE PLACE OF DISCIPLINE IN THE STRUCTURE OF OPOP VO

Academic discipline (module) B1.0.22 Ecology refers to the compulsory part of the bachelor's degree program of Block 1 Disciplines (modules) in accordance with the Federal State Educational Standard of Higher Education in the direction of 27.03.05 Innovation.

List of subsequent academic disciplines that require the knowledge, skills and abilities developed by this academic discipline: Environmental management

## III. REQUIREMENTS FOR THE RESULTS OF MASTERING THE DISCIPLINE

The process of mastering the discipline is aimed at developing the competencies of OPK - 1.2 , OPK- 2.3, OPK- 6.1, OPK- 6.2 , OPK - 6.3 in accordance with the Federal State Educational Standard of Higher Education and the Professional Educational Standard of Higher Education in the direction of 27.03.05 Innovation

**List of planned learning outcomes for a discipline (module), correlated with indicators of achievement of competencies**

| Competence | Competency indicators | Learning outcomes |
|---|---|---|
| OPK 1 Able to analyze the tasks of professional activity based on provisions, laws and methods in the field of mathematics, natural and technical sciences | OPK-1.2 Able to analyze the tasks of professional management activities based on provisions, laws and methods in the field of natural sciences | Knows:<br>- The main environmental problems of our time and their causes.<br>- principles of sustainable development and rational use of natural resources.<br>- norms and rules governing environmental safety and nature protection.<br>Can:<br>- assess the negative impacts of human activities on ecosystems.<br>- predict environmental risks and develop measures to prevent them.<br>- participate in decision-making processes aimed at maintaining the natural balance.<br>Owns:<br>- methods for assessing the ecological state of territories and ecosystems.<br>- tools for environmental monitoring and analysis of environmental data. |

| | | |
|---|---|---|
| | | - methods for assessing the effectiveness of environmental protection measures. |
| OPK - 2 Able to formulate objectives for professional activity based on knowledge of specialized sections of mathematical, technical and natural science disciplines (modules) | OPK-2.3 Able to formulate objectives of professional activity based on knowledge of specialized sections of natural sciences | Knows:<br>- structure and functional characteristics of ecosystems at different levels.<br>- forms of relationships between organisms within ecosystems.<br>- basic laws and principles of ecosystem functioning.<br>Can:<br>- to highlight key features of ecosystem stability and instability.<br>- assess the impact of external factors on the dynamics of ecosystems.<br>- propose strategies for stabilization and restoration of ecosystems.<br>Owns:<br>- method of analyzing the dynamics and state of ecosystems.<br>- models for predicting ecosystem changes.<br>- methods of inventory and monitoring of ecosystem components. |
| OPK - 6<br>Able to justify the adoption of a technical solution when developing an innovative project, select technical means and technologies, including taking into account the environmental consequences of their use | OPK - 6.1. Knowledge of methods for analyzing and selecting technical solutions in innovative activities; criteria for assessing the effectiveness and environmental safety of technologies; regulatory and legal requirements related to the environmental impact of technical solutions. | Knows:<br>- Fundamentals of classification and nomenclature of flora and fauna representatives.<br>- morphology and physiology of various groups of organisms.<br>- fundamentals of ecology and biology of the species studied.<br>Can:<br>- determine the taxonomic affiliation of organisms.<br>- establish connections between the organism and its living conditions.<br>Owns:<br>- search and identification of new species.<br>- application of special methods for studying flora and fauna.<br>- mastering terminology and modern research technologies. |
| | OPK - 6.2. Able to justify the adoption of a technical solution when developing an innovative project, evaluate the technical and economic efficiency and risks | Knows:<br>- modern methods of environmental analysis and monitoring.<br>- physicochemical and biological methods for assessing the state of ecosystems.<br>- new technologies in the field of environmental measurements and observations.<br>Can:<br>- conduct a field study of the ecosystem. |

| | | |
|---|---|---|
| | of proposed solutions, including taking into account the environmental consequences of their use | - obtain and process environmental monitoring data.<br>- use modern instruments and devices for environmental research.<br>Owns:<br>- methods of sampling and collecting samples for subsequent analysis.<br>- laboratory methods of chemical and microbiological analysis.<br>- specialists in software for processing and analyzing environmental data. |
| | OPK - 6.3. Possesses skills in working with regulatory documentation; modern tools for modeling and optimizing technical solutions; and skills in presenting and defending the chosen solution to experts and customers. | Knows:<br>- historically established and modern approaches to nature management.<br>- legislative norms and standards governing the use of natural resources.<br>- methods for assessing and accounting for the environmental consequences of human activities.<br>Can:<br>- assess the impact of various activities on ecosystems.<br>- solve practical problems of optimizing environmental management.<br>- balance the needs of society and concerns about environmental conservation.<br>Owns:<br>- the art of finding a compromise between economic and environmental goals.<br>- methods for taking environmental aspects into account in project activities.<br>- preparation of reports and recommendations for environmental authorities and private companies |

## IV. CONTENT AND STRUCTURE OF THE DISCIPLINE

**the discipline is 2 credit units , 72 hours ,**
including intermediate certification 8 (KO)

**Form of midterm assessment: credit with grade**

**4.1 The content of the discipline, structured by topic, indicating the types of classes and the number of academic hours allocated to them**

| **No. p/p** | **Section of discipline/topic** | **Semester** | **Total hours** | **Of these, practical training of students** | Types of educational work, including independent work of students, practical training and labor intensity (in hours) | | | | **Current Academic Performance Monitoring Form/ Form of interim assessment (by semester)** |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Contact work between the teacher and students | | | **Independent work/ KSR** | |
| | | | | | **Lecture** | **Seminar/ Practical, laboratory lesson** | **Consultation KO** | | |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
| **1** | Topic 1. Introduction. | **4** | **8** | | | **3** | | **3** | Test/oral survey |
| **2** | Topic 2. Interaction between the organism and the environment. | **4** | 8 | | | 3 | | 3 | Test, oral survey |
| **3** | Topic 3. Environmental factors and resources. | **4** | 8 | | | 4 | 3 | 3 | Test, oral survey |
| **4** | Topic 4. Populations. | **4** | 8 | | | 4 | | 4 | Test, oral survey |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **5** | Topic 5. Communities. | **4** | 8 | | | 4 | | 4 | Test, oral survey |
| **6** | Topic 6. Ecosystems. | **4** | 8 | | | 4 | 3 | 4 | Test, oral survey |
| **7** | Topic 7. Biosphere. | **4** | 8 | | | 4 | | 3 | Test, oral survey |
| **8** | Topic 8. Man in the biosphere. | **4** | 8 | | | 4 | | 3 | Test, oral survey |
| **9** | Topic 9. Conclusion | **4** | 8 | | | 3 | 3 | 2 | Test, oral survey |
| | **Interim assessment** | | | | | | | | **Credit with grade** |
| | **Total hours** | | **72** | | | **34** | **9** | **29** | |

**4.2. Plan for extracurricular independent work of students in the discipline**

| Semester | Section title, topic | Independent work of students | | | Evaluation tool | Educational and methodological support for independent work |
|---|---|---|---|---|---|---|
| | | Type of independent work | Completion deadlines | Labor intensity (hours) | | |
| 4 | Topic 1. Introduction. | Study of literature and teaching materials for the course section.<br>Problem solving. | At the end of the 1st week of the semester | **3** | Test, oral survey | Literature from the list (section V) |
| 4 | Topic 2. Interaction between the organism and the environment. | Study of literature and teaching materials for the course section.<br>Problem solving. | At the end of the 2nd week of the semester | 3 | Test, oral survey | Literature from the list (section V) |

| Semester | Section title, topic | Independent work of students | | | Evaluation tool | Educational and methodological support for independent work |
|---|---|---|---|---|---|---|
| | | Type of independent work | Completion deadlines | Labor intensity (hours) | | |
| 4 | Topic 3. Environmental factors and resources. | Study of literature and teaching materials for the course section. Problem solving. | At the end of the 4th week of the semester | 3 | Test, oral survey | Literature from the list (section V) |
| 4 | Topic 4. Populations. | Study of literature and teaching materials for the course section. Problem solving. | At the end of the 6th week of the semester | 4 | Test, oral survey | Literature from the list (section V) |
| 4 | Topic 5. Communities. | Study of literature and teaching materials for the course section. Problem solving. | At the end of the 8th week of the semester | 4 | Test, oral survey | Literature from the list (section V) |
| 4 | Topic 6. Ecosystems. | Study of literature and teaching materials for the course section. Problem solving. | At the end of the 10th week of the semester | 4 | Test, oral survey | Literature from the list (section V) |
| 4 | Topic 7. Biosphere. | Study of literature and teaching materials for the course section. Problem solving. | At the end of the 12th week of the semester | 3 | Test, oral survey | Literature from the list (section V) |
| 4 | Topic 8. Man in the biosphere. | Study of literature and teaching materials for the course section. Problem solving. | At the end of the 14th week of the semester | 3 | Test, oral survey | Literature from the list (section V) |
| 4 | Topic 9. Conclusion | Study of literature and teaching materials for the course section. Problem solving. | At the end of the 16th week of the semester | 2 | Test, oral survey | Literature from the list (section V) |
| Total amount of independent work on the subject (hours) | | | | **29** | | |

### 4.3.Content of educational material

**Topic 1. Introduction.**
The place of ecology in the natural sciences. The modern understanding of ecology as the science of ecosystems and the biosphere. Ernst Haeckel coined the term "ecology" to describe the science of the relationship between organisms and the environment. The formation of the biosphere through the vital activity of organisms, the interaction of biota and inert matter: the composition of air, water, and the origin of soil. Problems associated with anthropogenic impact on the biosphere. The environmental crisis. The connection between ecology and social processes. The importance of environmental education and upbringing. The need to develop legal and ethical norms for human relations with nature.

**Topic 2. Interaction between the organism and the environment.**
Fundamental properties of living systems. Levels of biological organization. The principle of emergence. The organism as a discrete, self-reproducing open system, linked to the environment by the exchange of matter, energy, and information. Trophic relationships between organisms: producers, consumers, and decomposers. Homeostasis (maintaining a constant internal environment); principles of regulation of vital functions. General principles of adaptation of organisms to changing environmental conditions, the rule of two levels of adaptation. Genetic limits of adaptation. Eurybionts and stenobionts. Principles of reproduction and development of various organisms. Features of the organism's dependence on the environment at different stages of the life cycle. Critical periods of development.

**Topic 3. Environmental factors and resources.**
Forms of impact of environmental factors and their compensation. Concept of the physicochemical environment of organisms; features of water, soil and air environments. Abiotic, biotic and anthropogenic factors. Environment-forming and limiting factors. Liebig's law of the minimum; Shelford's law of tolerance. Complex interaction of environmental factors. Ecological significance of the main abiotic factors: heat, Illumination, humidity, nutrient concentration, and edaphic factors. Replaceable and irreplaceable resources. The signaling value of abiotic factors. Distribution of species along a gradient of conditions. The concept of an ecological niche: potential and realized niches. Living organisms as indicators of the environment as a complex of ecological factors. Classification of life forms of plants and animals.

**Topic 4. Populations.**
Definition of the terms "biological species" and "population". Hierarchical structure of populations; dispersal of organisms and interpopulation relationships. Population as an element of an ecosystem. Static characteristics of a population: size, density, age and sex composition. Biomass and its expression: wet and dry weight, energy equivalent. Methods for estimating population size and density. The nature of the spatial distribution of individuals and its identification. Random, uniform and aggregated distribution. Mechanisms for maintaining spatial structure. Territoriality. Clusters of animals and plants, the reasons for their occurrence. Dynamic characteristics of a population: birth rate, mortality, population growth rate. Survival tables and curves. The nature of the distribution of mortality by age in different groups of animals and plants. Exponential and logistic models of population growth. K-strategy and r-strategy of populations. Specific population growth rate, "saturation density" as an indicator of the carrying capacity of the environment. Biomass dynamics.

**Topic 5. Communities.**
Biocenoses (communities), their taxonomic composition and functional structure. Types of relationships between organisms. The concept of symbiosis. Neutralism, amensalism, mutualism , commensalism, competition, biotrophy (predation in the broad sense of the word). Interspecific competition. Exploitation and interference. Gause's principle of competitive exclusion. Conditions for

the coexistence of competing species. Competition and distribution of species in nature. Predator-prey relationships. Coupled fluctuations in the population size of predator and prey. Coupled evolution. Species structure of communities and methods for its detection. Species diversity as a specific characteristic of a community. Community dynamics over time. Succession. Serial and climax communities.

**Topic 6. Ecosystems.**
Definition of the term "ecosystem". Ecosystems as chorological units of the biosphere. Components of ecosystems; main factors that ensure their existence. Development of ecosystems: succession. Main stages of matter and energy use in ecosystems. Trophic levels. Primary production - production of autotrophic organisms. Importance of photo- and chemosynthesis. Net and gross production. Respiration costs. Main methods of assessing primary production. Destruction of organic matter in an ecosystem. Biotrophs and saprotrophs. Food chains of "grazing" (grazing) and food chains of "decomposition" (detrital). Energy losses during the transition from one trophic level to another. Ecological efficiency. "Pyramid of production" and "pyramid of biomass". Micro- and macroreducers (consumers). Climatic zonation and main types of terrestrial ecosystems. Features of succession of terrestrial ecosystems. Aquatic ecosystems and their main features. Differences between aquatic and terrestrial elements of ecosystems. Species diversity as a key factor in ecosystem sustainability.

**Topic 7. Biosphere.**
The structure of the Earth, its shells, their structure, interrelationships, dynamics. Natural landscapes. Biosphere. The role of V.I. Vernadsky in the formation of the modern concept of the biosphere. Living and non-living matter, their interpenetration and transformation in the cycles of matter and energy. Functional integrity of the biosphere. Energy balance of the biosphere. The cycle of the most important chemical elements in the biosphere. The transformative influence of living things on the habitat. The self-purification effect. Metabolic processes in organisms as a key stage of bioproductivity. Biogeochemical functions of different groups of organisms. Biodiversity as a resource of the biosphere. Primary production of land and ocean. Potential productivity of the Earth. Distribution of solar radiation on the Earth's surface. The role of the atmosphere in heat retention. The main stages of the evolution of the biosphere. Noosphere.

**Topic 8. Man in the biosphere.**
Humans as a biological species. Their ecological niche. Ecology and human health. Human population characteristics. Human ecology: demographic issues, the development of technological civilization, and the resources of the biosphere. Intentional and unintentional, direct and indirect human impact on nature. The ecological crisis. Limited resources and environmental pollution as factors limiting human development. Nonlinear modeling and synergetic approaches to forecasting biospheric processes and the future of humanity.

**Topic 9. Conclusion.**
Economic, aesthetic, and ethical reasons for protecting nature. The transition from anthropocentrism to biocentrism in the context of developing new principles for human interaction with nature. "Reverence for life" (Schweitzer) as a possible ethical basis for human interaction with the biosphere.

**4.3.1. List of seminars, practical classes and laboratory work**

| No. p/p | Section and topic number | Name of seminars, practical and laboratory work | Labor intensity (hour.) | | Evaluation means | Developed competencies (indicators)* |
|---|---|---|---|---|---|---|
| | | | Total hours | Of these practical Preparation | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1 | 1 | The place of ecology in the natural sciences. The modern understanding of ecology as the science of ecosystems and the biosphere. Ernst Haeckel coined the term "ecology" to describe the science of the relationship between organisms and the environment. The formation of the biosphere through the vital activity of organisms, the interaction of biota and inert matter: the composition of air, water, and the origin of soil. Problems associated with anthropogenic impact on the biosphere. The environmental crisis. The connection between ecology and social processes. The importance of environmental education and upbringing. The need to develop legal and ethical norms for human relations with nature. | **3** | --- | Test | **OPK 2.3.** |
| 2 | 2 | Fundamental properties of living systems. Levels of biological organization. The principle of emergence. The organism as a discrete, self-reproducing open system, linked to the environment by the exchange of matter, energy, and information. Trophic relationships between organisms: producers, consumers, and decomposers. Homeostasis (maintaining a constant internal environment); principles of regulation of vital functions. General principles of adaptation of organisms to changing environmental conditions, the rule of two levels of adaptation. Genetic limits of adaptation. Eurybionts and stenobionts. Principles of reproduction and development of various organisms. Features of the organism's dependence on the environment at different stages of the life cycle. Critical periods of development. | 3 | --- | Test, oral survey | **OPK 1.2.** |

| No. p/p | Section and topic number | Name of seminars, practical and laboratory work | Labor intensity (hour.) | | Evaluation means | Developed competencies (indicators)* |
|---|---|---|---|---|---|---|
| | | | Total hours | Of these practical Preparation | | |
| 3 | 3 | Forms of impact of environmental factors and their compensation. Concept of the physicochemical habitat of organisms; features of water, soil and air environments. Abiotic, biotic and anthropogenic factors. Environment-forming and limiting factors. Liebig's law of minimum; Shelford's law of tolerance. Complex interaction of environmental factors. Ecological significance of the main abiotic factors: heat, light , humidity, salinity, concentration of biogenic elements, edaphic factors. Replaceable and irreplaceable resources. Signal value of abiotic factors. Distribution of individual species along a gradient of conditions. Concept of an ecological niche: potential and realized niche. Living organisms are indicators of the environment as a complex of environmental factors. Classification of plant and animal life forms. | 4 | --- | Test, oral survey | **OPK 6.1. OPK 6.2. OPK 6.3.** |
| 4 | 4 | Definition of the terms "biological species" and "population". Hierarchical structure of populations; dispersal of organisms and interpopulation relationships. Population as an element of an ecosystem. Static characteristics of a population: size, density, age and sex composition. Biomass and its expression: wet and dry weight, energy equivalent. Methods for estimating population size and density. The nature of the spatial distribution of individuals and its identification. Random, uniform and aggregated distribution. Mechanisms for maintaining spatial structure. Territoriality. Clusters of animals and plants, the reasons for their occurrence. Dynamic characteristics of a population: birth rate, mortality, population growth rate. Survival tables and curves. The nature of the | 4 | | Test, oral survey | **OPK 1.2.** |

| No. p/p | Section and topic number | Name of seminars, practical and laboratory work | Labor intensity (hour.) | | Evaluation means | Developed competencies (indicators)* |
|---|---|---|---|---|---|---|
| | | | Total hours | Of these practical Preparation | | |
| | | distribution of mortality by age in different groups of animals and plants. Exponential and logistic models of population growth. K-strategy and r-strategy of populations. Specific population growth rate, "saturation density" as an indicator of the carrying capacity of the environment. Biomass dynamics. | | | | |
| 5 | 5 | Biocenoses (communities), their taxonomic composition and functional structure. Types of relationships between organisms. The concept of symbiosis. Neutralism, amensalism, mutualism , commensalism, competition, biotrophy (predation in the broad sense of the word). Interspecific competition. Exploitation and interference. Gause's principle of competitive exclusion. Conditions for the coexistence of competing species. Competition and distribution of species in nature. Predator-prey relationships. Coupled fluctuations in the population size of predator and prey. Coupled evolution. Species structure of communities and methods for its detection. Species diversity as a specific characteristic of a community. Community dynamics over time. Succession. Serial and climax communities. | 4 | | Test, oral survey | **OPK 2.3.** |
| 6 | 6 | Definition of the term "ecosystem". Ecosystems as chorological units of the biosphere. Components of ecosystems; main factors that ensure their existence. Development of ecosystems: succession. Main stages of matter and energy use in ecosystems. Trophic levels. Primary production - production of autotrophic organisms. Importance of photo- and chemosynthesis. Net and gross production. Respiration costs. Main methods of assessing primary production. Destruction of organic | 4 | | Test, oral survey | **OPK 6.1. OPK 6.2. OPK 6.3.** |

| No. p/p | Section and topic number | Name of seminars, practical and laboratory work | Labor intensity (hour.) | | Evaluation means | Developed competencies (indicators)* |
|---|---|---|---|---|---|---|
| | | | Total hours | Of these practical Preparation | | |
| | | matter in an ecosystem. Biotrophs and saprotrophs. Food chains of "grazing" (grazing) and food chains of "decomposition" (detrital). Energy losses during the transition from one trophic level to another. Ecological efficiency. "Pyramid of production" and "pyramid of biomass". Micro- and macroreducers (consumers). Climatic zonation and main types of terrestrial ecosystems. Features of succession of terrestrial ecosystems. Aquatic ecosystems and their main features. Differences between aquatic and terrestrial elements of ecosystems. Species diversity as a key factor in ecosystem sustainability. | | | | |
| 7 | 7 | The structure of the Earth, its shells, their structure, interrelationships, dynamics. Natural landscapes. Biosphere. The role of V.I. Vernadsky in the formation of the modern concept of the biosphere. Living and non-living matter, their interpenetration and transformation in the cycles of matter and energy. Functional integrity of the biosphere. Energy balance of the biosphere. The cycle of the most important chemical elements in the biosphere. The transformative influence of living things on the habitat. The self-purification effect. Metabolic processes in organisms as a key stage of bioproductivity. Biogeochemical functions of different groups of organisms. Biodiversity as a resource of the biosphere. Primary production of land and ocean. Potential productivity of the Earth. Distribution of solar radiation on the Earth's surface. The role of the atmosphere in heat retention. The main stages of the evolution of the biosphere. Noosphere. | 4 | | Test, oral survey | **OPK 1.2.** |

| No. p/p | Section and topic number | Name of seminars, practical and laboratory work | Labor intensity (hour.) | | Evaluation means | Developed competencies (indicators)* |
|---|---|---|---|---|---|---|
| | | | Total hours | Of these practical Preparation | | |
| 8 | 8 | Humans as a biological species. Their ecological niche. Ecology and human health. Human population characteristics. Human ecology: demographic issues, the development of technological civilization, and the resources of the biosphere. Intentional and unintentional, direct and indirect human impact on nature. The ecological crisis. Limited resources and environmental pollution as factors limiting human development. Nonlinear modeling and synergetic approaches to forecasting biospheric processes and the future of humanity. | 4 | | Test, oral survey | **OPK 2.3.** |
| 9 | 9 | Economic, aesthetic, and ethical reasons for protecting nature. "Reverence for life" (Schweitzer) as a possible ethical basis for human interaction with the biosphere. The transition from anthropocentrism to biocentrism. | 3 | | Test, oral survey | **OPK 1.2.** |

**4.3.2. List of topics (questions) submitted for independent study by students as part of independent work (IWS)**

| No. p/p | Topic | Exercise | Competence being developed | IDK |
|---|---|---|---|---|
| **1** | **2** | **3** | **4** | **5** |
| 1 | Topic 1. Introduction. | Reading literature and teaching materials on the topic, studying basic concepts and tools, solving problems. | **OPK 2** | **OPK 2.3.** |
| 2 | Topic 2. Interaction between the organism and the environment. | Reading literature and teaching materials on the topic, studying basic concepts and tools, solving problems. | **OPK 1** | **OPK 1.2.** |
| 3 | Topic 3. Environmental factors and resources. | Reading literature and teaching materials on the topic, studying basic concepts and tools, solving problems. | **OPK 6** | **OPK 6.1. OPK 6.2. OPK 6.3.** |

| No. p/p | Topic | Exercise | Competence being developed | IDK |
|---|---|---|---|---|
| 4 | Topic 4. Populations. | Reading literature and teaching materials on the topic, studying basic concepts and tools, solving problems. | **OPK 1** | **OPK 1.2.** |
| 5 | Topic 5. Communities. | Reading literature and teaching materials on the topic, studying basic concepts and tools, solving problems. | **OPK 2** | **OPK 2.3.** |
| 6 | Topic 6. Ecosystems. | Reading literature and teaching materials on the topic, studying basic concepts and tools, solving problems. | **OPK 6** | **OPK 6.1. OPK 6.2. OPK 6.3.** |
| 7 | Topic 7. Biosphere. | Reading literature and teaching materials on the topic, studying basic concepts and tools, solving problems. | **OPK 1** | **OPK 1.2.** |
| 8 | Topic 8. Man in the biosphere. | Reading literature and teaching materials on the topic, studying basic concepts and tools, solving problems. | **OPK 2** | **OPK 2.3.** |
| 9 | Topic 9. Conclusion | Reading literature and teaching materials on the topic, studying basic concepts and tools, solving problems. | **OPK 1** | **OPK 1.2.** |

**4.4. Guidelines for organizing students' independent work**

Students' independent work is conducted using e-learning and distance learning technologies. Educational and methodological materials for independent study are available to students through electronic library systems and the Hekadem online learning system, which features lecture materials and practical assignments, interactive learning formats, and sample assignments. Each student receives authorized access to the system. The Hekadem online learning system is a distance learning and digital learning platform for the Baikal International Business School of Irkutsk State University. Access: https://edu.buk.irk.ru.

Independent work consists of:

– in independent student preparation for a lecture, including reading notes from the previous lecture and watching a video version of the lecture (if available). This helps students better understand the material in the new lecture, building on their prior knowledge;

– in preparation for practical classes on basic and additional sources of literature;

– in independent study of individual topics or questions using textbooks or teaching aids, sources on the Internet and on the university's electronic portal;

– in preparation for ongoing monitoring and midterm assessment.

Monitoring of independent work is carried out when the student completes assignments from the assessment materials for the discipline.

When completing independent work, the student must also take into account the criteria for assessing the completed assignment (section 8 of this program).

During the assessment of independent work, both the students' factual knowledge, skills, and abilities are assessed, as well as the depth of understanding and ability to isolate and interpret holistic semantic structures, as well as the skills to independently search for the necessary information on the topic of the lesson and its critical evaluation.

## V. EDUCATIONAL, METHODOLOGICAL AND INFORMATIONAL SUPPORT FOR THE DISCIPLINE (MODULE)

### a) list of references


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2. Gorbunov **S.S. The Ethics of Albert** Schweitzer's " Reverence for Life" in the Context of Modern Environmental Issues : Dissertation ... Candidate of Philosophical Sciences: 09.00.05 / Gorbunov S. S. [ Place of protection: Federal State Budgetary Educational Institution of Higher Education "National Research Mordovian State University named after N.P. Ogarev"]. - Saransk, 2020. - 177 p.
3. Eremchenko, O. Z. The doctrine of the biosphere: a textbook for universities / O. Z. Eremchenko. - 3rd ed., revised. and additional. - Moscow: Yurait Publishing House, 2025. - 224 p. ; ISBN 978-5-534-08283-8.
4. Erdakov, L.N. Population dynamics: chronoecological aspect / L. N. Erdakov ; Federal State Budgetary Educational Institution of Higher Education Institute of Animal Taxonomy and Ecology of the Siberian Branch of the Russian Academy of Sciences. - Moscow: KMK, 2023. - 249 p.; ISBN 978-5-907747-04-3
5. Mavrischev V.V. General ecology: a course of lectures / V.V. Mavrishchev. - 3rd ed., printed - M.: Infra-M; Minsk: New knowledge, 2012.- 297 pp.- ISBN 978-5-16-004684-6.- ISBN 978-985 475-435-2
6. Potapova E.V. General ecology: textbook. Part 2: Field research methods. / E.V. Potapova. - Irkutsk: Irkutsk State University Publishing House, 2015. - 155 p. ISBN 978-5-9624-0769-2
7. Titov , E.V. Ecology . - Moscow: Academy, 2023. ISBN 978-5-0054-1041-2
8. Shilov, *I.A.* Biocenology: a textbook for universities / I. A. Shilov. - Moscow: Yurait Publishing House, 2024. - 184 p. ISBN 978-5-534-13190-1.
9. Ecology . Theory. Practice: a textbook / O. V. Masleeva, V. V. Gridneva , O. N. Kovaleva [et al.]. - Nizhny Novgorod: NSTU named after R. E. Alekseev, 2024. - 220 p. ISBN 978-5-502-01841-8
10. Ecology : textbook and practical training for universities / edited by O. E. Kondratieva. - Moscow: Yurait Publishing House, 2024. - 283 p. ISBN 978-5-534-00769-5.


### b) Databases, information and reference and search systems

1. Electronic Library System of the Electronic Library System "Bibliotech". State contract No. 019 dated February 22, 2011. Bibliotech LLC. License agreement No. 31 dated February 22, 2011. Access address: https://isu.bibliotech.ru/ Valid from November 22, 2011, indefinitely.
2. Electronic Library System "Rukont" Contract No. 98 dated November 13, 2020; Act No. БК-5415 dated November 14, 2020. Valid until November 13, 2021. Access: http://rucont.ru/
3. Electronic Library System "Lan Publishing House." Lan Publishing House LLC. Information Letter No. 128 dated October 9, 2017. Validity: unlimited. Access address: http://e.lanbook.com/
4. Electronic Library System "National Digital Resource "Rukont." Central Design Bureau "Bibcom." Contract No. 04-E-0343 dated November 12, 2021. Access address: http://rucont.ru/
5. Electronic Library System "ibooks.ru/ibooks.ru". LLC "ibooks". Contract No. 04-E-0344 dated November 12, 2021; Act dated November 14, 2021. Access address: http://ibooks.ru
6. Electronic Library System "EBS Yurait." Yurait Electronic Publishing House LLC. Contract No. 04-E-0258 dated September 20, 2021. Access address: https://urait.ru/

## VI. LOGISTIC AND TECHNICAL SUPPORT OF THE DISCIPLINE (MODULE)

### 6.1. Educational and laboratory equipment

| Name of special rooms and rooms for independent work | Equipment special rooms and rooms for independent work | List of licensed software. Details of the supporting document |
|---|---|---|
| A classroom for conducting lecture-type classes | The auditorium is equipped with specialized (educational) furniture for 48 students and technical teaching aids for presenting educational information to a large audience. The set of demonstration equipment includes:<br>1. PC HP Elite 8300 SFF i5 3470/4Gb/1Tb/DVDRV/kb/m/DOS/Solenoid Lock and Hood Sensor (RUS)<br>2. Viewsonic TFT 20" monitor VA2014WM glossy-black 5ms 20 00:1 250cd M/M<br>3. Epson EB-1830 projector 4. Speakers Active Genius SP-S110 black<br>5. Splitter video signal Aten VS92A 2-port VGA<br>Equipped with teaching aids and electronic presentations that provide thematic illustrations on all topics specified in the course curriculum | BASIC INSTALLATION KIT OF SOFTWARE:<br>Office 2007 Russian OpenLicensePack NoLevel AcademicEdition – agreement with SoftLine Trade CJSC Tr026664 dated 17.05.2007 Project Standard 2007, Access 2007 - Academic cooperation programs with Microsoft DreamSpark Premium Electronic Software Delivery. – agreement with SoftLine Trade CJSC Tr000023480 dated 19.05.2015 Windows operating systems under licensed OEM preinstallation programs, Academic cooperation programs with Microsoft MSDN AA. - agreement with SoftLine Trade CJSC Tr017431 dated 15.05.2008 Windows operating systems under licensed OEM preinstallation programs, Academic cooperation programs with Microsoft DreamSpark Premium Electronic Software Delivery. – agreement with SoftLine Trade CJSC Tr000031723 dated 08/05/2015 Antivirus programs - Rights to computer programs drWeb Server Security comprehensive protection 120 PCs (1 license per year) migration with additional purchase (LBW-BC-12M-120:119-C4) – agreement with SoftLine Trade CJSC 13982/MOS2957 dated 01/22/2016 WinRAR archivers: 3.x: Standard Licence - for legal entities 100-199 licenses – agreement with SoftLine Trade CJSC No. 15422/IRK11 dated 02/05/2010 Network client part Rights to computer programs Windows Server CAL 2012 Russian OLP NL Akademic Edition Device CAL 120 licenses – contract with SoftLine Trade CJSC 13512/MOS2957 dated October 29, 2015. Firewall, Proxy functionality - Right to use Traffic Inspector GOLD computer programs at a preferential rate – contract with SoftLine Trade CJSC Tr044356 dated August 27, 2013. Right to use Traffic Inspector GOLD Special computer programs. Renewal for 1 year – contract with SoftLine Trade CJSC Tr000112196 dated September 29, 2016. |
| Classroom for conducting seminar-type classes | The auditorium is equipped with specialized (educational) furniture for 48 students and technical teaching aids for presenting educational information to a large audience.<br>The demonstration equipment set includes: 1. HP Elite 8300 SFF i5 3470/4Gb/1Tb/DVDRV/kb/m/DOS/Solenoid Lock and Hood Sensor (RUS)<br>2. Viewsonic TFT 20" VA2014WM glossy-black 5ms 20 00:1 250cd M/M monitor<br>3. Epson EB-1830 projector 4. Speakers Active Genius SP-S110 black<br>5. Splitter video signal Aten VS92A 2-port VGA | BASE INSTALLATION SET Software :<br>Office 2007 Russian OpenLicensePack NoLevel Academic Edition – agreement With SoftLine CJSC Trade " Tr026664 from 05/17/2007 Project Standard 2007, Access 2007 - Programs academic cooperation with Microsoft DreamSpark Premium Electronic Software Delivery – agreement With SoftLine CJSC Trade " Tr000023480 from 05/19/2015<br>Operational Windows systems by licensed programs OEM presets , Programs academic cooperation with Microsoft MSDN AA. - agreement With SoftLine CJSC Trade " Tr017431 from 05/15/2008<br>Operational Windows systems by licensed programs OEM presets , Programs academic cooperation with Microsoft DreamSpark Premium Electronic Software Delivery – agreement With SoftLine CJSC Trade " Tr000031723 from 08/05/2015<br>Antivirus programs - Rights on programs For DrWeb Server Security comprehensive computer protection for 120 PCs (1 license) for year ) migration With additional purchase (LBW-BC-12M-120:119-C4) – contract With SoftLine CJSC Trade " 13982 / MOS 2957 from 01/22/2016 WinRAR<br>archivers : 3.x: Standard License - for legal persons 100-199 licenses - agreement With SoftLine CJSC Trade "No. 15422/IRK11 from 02/05/2010<br>Network client Part Rights on programs For Windows Server CAL 2012 Russian OLP NL Akademic Edition Device CAL 120 licenses – |

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| | | contract With SoftLine CJSC Trade "13512/ MOS 2957 dated 10.29.2015<br>Internetwork screen , proxy functionality - Law use programs For Traffic Inspector GOLD computer discount – contract With SoftLine CJSC Trade " Tr044356 from 08/27/2013<br>Law use programs For computer Renewal of Traffic Inspector GOLD Special for 1 year – contract With SoftLine CJSC Trade " Tr000112196 from September 29, 2016 |
| Audience for group and individual consultations, ongoing monitoring and midterm assessment | The classroom is equipped with specialized (educational) furniture for 11 students, 5 workstations equipped with computers with Internet connection and access to the Irkutsk State University Electronic Information and Information System. 1. 5 workstations System unit HP compad dc7800SFF Dual Core PE-2180, 4 Gb DDR2 PC6400, 160GB SATA 3.0 HDD<br>2. Monitor LCD display 17.0 "ViewSonic "VA703m" 1280x1024, 8mc, TCO"03, silver-black (D-Sub, MM) 3. Printer Multifunctional device Hewlett-Packard LaserJet 3055 All-in-One one piece. | BASIC INSTALLATION KIT OF SOFTWARE:<br>Office 2007 Russian OpenLicensePack NoLevel AcademicEdition – agreement with SoftLine Trade CJSC Tr026664 dated 17.05.2007 Project Standard 2007, Access 2007 - Academic cooperation programs with Microsoft DreamSpark Premium Electronic Software Delivery. – agreement with SoftLine Trade CJSC Tr000023480 dated 19.05.2015 Windows operating systems under licensed OEM preinstallation programs, Academic cooperation programs with Microsoft MSDN AA. - agreement with SoftLine Trade CJSC Tr017431 dated 15.05.2008 Windows operating systems under licensed OEM preinstallation programs, Academic cooperation programs with Microsoft DreamSpark Premium Electronic Software Delivery. – agreement with SoftLine Trade CJSC Tr000031723 dated 08/05/2015 Antivirus programs - Rights to computer programs drWeb Server Security comprehensive protection 120 PCs (1 license per year) migration with additional purchase (LBW-BC-12M-120:119-C4) – agreement with SoftLine Trade CJSC 13982/MOS2957 dated 01/22/2016 WinRAR archivers: 3.x: Standard Licence - for legal entities 100-199 licenses – agreement with SoftLine Trade CJSC No. 15422/IRK11 dated 02/05/2010 Network client part Rights to computer programs Windows Server CAL 2012 Russian OLP NL Akademic Edition Device CAL 120 licenses – contract with SoftLine Trade CJSC 13512/MOS2957 dated October 29, 2015. Firewall, Proxy functionality - Right to use Traffic Inspector GOLD computer programs at a preferential rate – contract with SoftLine Trade CJSC Tr044356 dated August 27, 2013. Right to use Traffic Inspector GOLD Special computer programs. Renewal for 1 year – contract with SoftLine Trade CJSC Tr000112196 dated September 29, 2016. |
| Room for independent work of students | Equipped with specialized (educational) furniture for 10 students, equipped with computer equipment connected to the Internet and provided with access to the ISU Electronic Information System<br>1. ThinkCentre M80 Series SFF system unit included: Intel® Core™ i3-540 Clarkdale 2.93GHz / 1333MHz / Dual Core™ / 4M/73W / LGA 1156/32nm/4GB PC3-10600 SDRAM x 2 / 250 GB, 7200RPM SATA | BASIC INSTALLATION KIT OF SOFTWARE:<br>Office 2007 Russian OpenLicensePack NoLevel AcademicEdition – agreement with SoftLine Trade CJSC Tr026664 dated 17.05.2007 Project Standard 2007, Access 2007 - Academic cooperation programs with Microsoft DreamSpark Premium Electronic Software Delivery. – agreement with SoftLine Trade CJSC Tr000023480 dated 19.05.2015 Windows operating systems under licensed OEM preinstallation programs, Academic cooperation programs with Microsoft MSDN AA. - agreement with SoftLine Trade CJSC Tr017431 dated 15.05.2008<br>Windows operating systems under licensed OEM preinstallation programs, Academic cooperation programs with Microsoft DreamSpark Premium Electronic Software Delivery. – Agreement with SoftLine Trade CJSC Tr000031723 dated 05.08.2015 Antivirus programs - Rights to computer programs drWeb Server Security comprehensive protection 120 PCs (1 license per year) |

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|---|---|---|
| | /DVD RW - 10pcs<br>2. LCD monitor - monitor 20.0 ViewSonic "VA2013w" 1600x900, 5mc, TCO 03, black (D-Sub) - 10pcs3. Printer HP LaserJet 5000N, A3, 22ppm, 32 MB, 250&500 sheet feeder, JetDirect 615n prn svr<br>4. Printer HP LaserJet 5100th, A3, 22ppm, 32 MB, 250&500 sheet feeder, JetDirect 615n prn svr | migration With additional purchase (LBW-BC-12M-120:119-C4) – contract With SoftLine CJSC Trade " 13982 / MOS 2957 from 01/22/2016 WinRAR<br>archivers : 3.x: Standard License - for legal persons 100-199 licenses - agreement With SoftLine CJSC Trade "No. 15422/IRK11 from 02/05/2010<br>Network client Part Rights on programs For Windows Server CAL 2012 Russian OLP NL Akademic Edition Device CAL 120 licenses – contract With SoftLine CJSC Trade "13512/ MOS 2957 dated 10.29.2015<br>Internetwork screen , proxy functionality - Law use programs For Traffic Inspector GOLD computer discount – contract With SoftLine CJSC Trade " Tr044356 from 08/27/2013<br>Law use programs For computer Renewal of Traffic Inspector GOLD Special for 1 year – contract With SoftLine CJSC Trade " Tr000112196 from September 29, 2016 |

**6.2. Software**

The University is provided with the necessary set of licensed and freely distributed software, including domestically produced:

1. Basic installation kit for: Office 2010. Services for providing the right to use the Microsoft Desktop Edu program. ALNG LicSAPk OLV E 1Y Acdmc Ent., 39 licenses for BMBS ISU. Agreement No. 03-K-1131 dated November 29, 2021. KOSGU 226.4.
2. Project Standard 2007, Access 2007 – Subscription ISU Azure Dev Tools for Teaching subscription (Visio, Projekt) 1 Year. Microsoft Corporation, One Microsoft Way, Redmond, WA 98052. Expiration Date March 31, 2023.
3. Microsoft Project Professional 2010, Subscription ISU Azure Dev Tools for Teaching subscription (Visio, Projekt) 1 Year. Microsoft Corporation, One Microsoft Way, Redmond, WA 98052. Expiration Date March 31, 2023.
4. Operating Windows 7, Windows 10 systems Services By provision rights use Microsoft Desktop Edu ALNG LicSAPk OLV E 1Y Acdmc Ent., 39 licenses For BMBS ISU . Agreement No. 03-K-1131 dated November 29, 2021 KOSGU 226.4
5. Antivirus programs - Dr.Web renewal Agreement No. Tr000582689/03-E-0043 dated February 5, 2021 Invoice No. Tr000582689 dated February 8, 2021
6. WinRAR archivers: 3.x: Standard License - for legal entities 100-199 licenses - Appendix No. 1 to Agreement No. 15422/IRK11 of SoftLine Trade CJSC dated February 5, 2010
7. Network client part Rights to computer programs Windows Server CAL 2012 Russian OLP NL Akademic Edition Device CAL 120 licenses - invoice Tr000051059 SoftLine Trade CJSC dated October 27, 2015
8. Firewall, Proxy functionality - Right to use Traffic Inspector GOLD computer programs, preferential account Tr005456, SoftLine Trade CJSC, dated August 27, 2013
9. Traffic Inspector GOLD Special* for 5 years Agreement RSZ-0000276 dated November 16, 2021 KOSGU 226.4 License renewal

**6.3. Technical and electronic teaching aids**

Multimedia tools and other equipment for presentation of educational materials:

1. Desktop PC HP ElliteDesk 800 G4 SFF Intel Core i5 8500 (3Ghz)/8192Mb/1000Gb/DVDrw/war 3y/W10Pro +V

2. Monitor ViewSonic 21.5" VA2245a - LED [LED, 1920x1080, 10M: 1 5 ms , 170 hor , 160 vert , D-Sub]

3. Nec M420X LCD Projector 4200 ANSI Lm XGA 2000:1 Lamp 3500 Hour Eco Mode HDMI USB Viewer RJ-45 10W 3.6 kg

4. Jetbalance JB-115U 2.0 Speakers Black (4W)

5. Splitter video signal Aten VS92A 2-port VGA

List of licensed software used:

1. Office 2010 by program academic cooperation with Russian Microsoft Desktop Education AllLng License/Software Assurance Pack Academic OLV 1License LevelEEnterprise

2. Project Standard 2007, Access 2007 – by program academic cooperation with Microsoft DreamSpark Premium Electronic Software Delivery.

3. Microsoft Project Professional 2010, Microsoft Visio Professional 2010 according to the program academic cooperation with Microsoft Imagine Standard Electronic Software Delivery at assistance CNIT ISU .

## VII. EDUCATIONAL TECHNOLOGIES

Educational technologies used in teaching the discipline:

- lecture-seminar credit system;
- analysis of situations (problems, examples);
- collaborative learning (teamwork, group work);
- information and communication.

Distance learning technologies used in teaching the discipline are implemented using the differentiated Internet learning system of the Irkutsk State University "Gekadem".

**Name of lesson topics with indication of forms/methods/technologies of teaching:**

| **No. p/p** | **Topic of the lesson** | **Type of activity** | Form/Methods/technologies of distance, interactive learning | **Number of hours** |
|---|---|---|---|---|
| **1** | **2** | **3** | **4** | **5** |
| 1 | Topic 1. Introduction. | Practical lesson | presentation, discussion | **3** |
| 2 | Topic 2. Interaction between the organism and the environment. | Practical lesson | presentation, discussion | 3 |
| 3 | Topic 3. Environmental factors and resources. | Practical lesson | test | 4 |
| 4 | Topic 4. Populations. | Practical lesson | test | 4 |
| 5 | Topic 5. Communities. | Practical lesson | test | 4 |
| 6 | Topic 6. Ecosystems. | Practical lesson | test | 4 |
| 7 | Topic 7. Biosphere. | Practical lesson | test | 4 |
| 8 | Topic 8. Man in the biosphere. | Practical lesson | test | 4 |
| 9 | Topic 9. Conclusion | Practical lesson | Discussion , test | 3 |
| **Total hours:** | | | | **34** |

## VIII. EVALUATION MATERIALS FOR CURRENT MONITORING AND INTERIM CERTIFICATION

**8.1 Materials for conducting current and intermediate monitoring of students' knowledge:**

| No. | Type of control | Controlled topics (sections) | Controlled competencies/indicators |
|---|---|---|---|
| **1** | **2** | **3** | **4** |
| 1 | **Current control** | | |
| 1.1 | Online test in the differentiated Internet learning system Hekadem | Topic 1. Introduction. | **OPK 2.3.** |
| 1.2 | Online test in the differentiated Internet learning system Hekadem | Topic 2. Interaction between the organism and the environment. | **OPK 1.2.** |
| 1.3 | Online test in the differentiated Internet learning system Hekadem | Topic 3. Environmental factors and resources. | **OPK 6.1. OPK 6.2. OPK 6.3.** |
| 1.4 | Online test in the differentiated Internet learning system Hekadem | Topic 4. Populations. | **OPK 1.2.** |
| 1.5 | Online test in the differentiated Internet learning system Hekadem | Topic 5. Communities. | **OPK 2.3.** |
| 1.6 | Online test in the differentiated Internet learning system Hekadem | Topic 6. Ecosystems. | **OPK 6.1. OPK 6.2. OPK 6.3.** |
| 1.7 | Online test in the differentiated Internet learning system Hekadem | Topic 7. Biosphere. | **OPK 1.2.** |
| 1.8 | Online test in the differentiated Internet learning system Hekadem | Topic 8. Man in the biosphere. | **OPK 2.3.** |
| 1.9 | Online test in the differentiated Internet learning system Hekadem | Topic 9. Conclusion | **OPK 1.2.** |
| 2 | **Interim assessment** | | **OPK 2.3.** |
| 2.1 | **Credit with grade** | All course topics | **OPK 1.2.** |

**8.1.1 Evaluation materials of current control**

**Examples of online test questions**

1. The term "ecology" was first coined by the German scientist Ernst Haeckel.
   Correct answer: True

2. Homeostasis refers to the body's ability to change the composition of its environment.
   Correct answer: False (homeostasis is maintaining a constant internal environment).

3. Shelford's law of tolerance reflects the limits of organisms' adaptability to environmental factors.
   The correct answer is: True

4. An ecological niche always coincides with a species' habitat.
   Correct answer: Incorrect (habitat is the geographic distribution, niche is the functional role of a species in an ecosystem)

5. In a biocenosis, competition between species can lead to the displacement of one species by

another.
The correct answer is: True

6. In a food pyramid, energy increases with each trophic level.
   Correct answer: Incorrect (energy decreases due to losses in respiration and metabolism)

7. Vernadsky introduced the concept of the "biosphere" and developed the theory of the noosphere.
   The correct answer is: True.

8. The limited availability of natural resources is one of the factors driving the environmental crisis.
   The correct answer is: True

9. Which of the following statements best describes producers?
   a) Organisms that break down organic matter into minerals b) Organisms that feed on other living things c) Organisms that create organic matter from inorganic compounds d) Organisms that use the energy of organic matter Correct answer: c

10. Which law in ecology formulates the rule that the growth of organisms is limited by the factor that is least abundant?
    a) Law of succession b) Liebig's law of the minimum c) Law of competitive exclusion Correct answer: b

11. What type of distribution of organisms across a territory is most common?
    a) Uniform
    b) Aggregated (group) c) Random d) Linear Correct answer: b

12. What is the name of the process of replacement of one community by another in a certain area?
    a) Homeostasis b) Succession c) Evolution d) Climax Correct answer: b

13. What does the biomass pyramid reflect?
    a) Energy losses at each trophic level b) The total mass of living matter at each trophic level c) The rate of reproduction of individuals in the population d) The number of individuals in the population Correct answer: b

14. What phenomenon characterizes the predator-prey interaction?
    a) Commensalism b) Mutualism c) Biotrophy d) Predation Correct answer: d

15. Which layer of the Earth is the area of life distribution?
    a) Atmosphere b) Lithosphere c) Biosphere d) Hydrosphere Correct answer: c

16. Which of the following statements is an example of a biocentric approach?
    a) Man is the highest goal of nature b) Nature is valuable only insofar as it is useful to man c) Nature has its own value, regardless of its usefulness to man d) The development of civilization is more important than the preservation of biodiversity The correct answer is: b

### 8.1.2 Assessment materials for conducting interim assessment in the form of a test

**Approximate list of questions:**

1. Define the term "ecology" and name its founder.
2. What is the place of ecology in the system of natural sciences?

3. What is meant by the modern interpretation of ecology as a science?
4. What is the role of organisms in the formation of the biosphere?
5. What environmental problems are associated with anthropogenic impact on nature?
6. What is homeostasis and why is it important for the body?
7. Explain the principle of emergence.
8. Describe producers, consumers and reducers.
9. What does the two-level adaptation rule mean?
10. Who are eurybionts and stenobionts?
11. What are the critical periods of an organism's development?
12. How does an organism exchange matter, energy and information with the environment?
13. Define abiotic, biotic and anthropogenic factors.
14. What is Liebig's law of minimum?
15. Explain Shelford's law of tolerance.
16. What are limiting factors?
17. What is the importance of the main abiotic factors (heat, light, humidity)?
18. What is the difference between fungible and non-fungible resources?
19. Provide a definition for the concept of "ecological niche".
20. What is the difference between a potential niche and a realized niche?
21. What are environmental indicator organisms?
22. What life forms of plants and animals are distinguished?
23. Define the term "population".
24. What are the statistical characteristics of a population?
25. What is biomass and how is it expressed?
26. What methods are used to estimate population sizes?
27. Name the types of spatial distribution of organisms in a population.
28. Explain the importance of territoriality in animals.
29. What is the birth and death rate in a population?
30. What are the survival curves?
31. What is the difference between exponential and logistic population growth?
32. What do r-strategy and K-strategy of population development mean?
33. Give a definition of the concept "biocenosis".
34. What types of interactions between organisms do you know?
35. What is symbiosis and its forms?
36. What is Gause's principle of competitive exclusion?
37. How do predator-prey relationships manifest themselves in nature?
38. What does concomitant evolution of species mean?
39. How is species diversity of a community revealed?
40. What is succession and what are its types?
41. Define the term "ecosystem ". What components does an ecosystem include?
42. What do the production pyramid and the biomass pyramid reflect?
43. What role did V. I. Vernadsky play in the development of the theory of the biosphere?
44. What is the noosphere and how does it differ from the biosphere?
45. The main postulate of Albert Schweitzer 's theory of the Ethics of Reverence for Life

**8.2 Evaluation criteria for intermediate and current controls:**

| **Evaluation criteria** | **Grade** |
|---|---|
| Less than 60% of answers are correct | 2 (unsatisfactory) |
| Correct answers not less than 60% and not less than 70% | 3 (satisfactory) |

| | |
|---|---|
| Correct answers more than 70% and not less than 85% | 4 (good) |
| More than 85% of answers are correct | 5 (excellent) |

**Developer:**

Senior Lecturer Ya.O. Dunaeva

The program is compiled in accordance with the requirements of the Federal State Educational Standard of Higher Education in the field of study 27.03.05 Innovation, training profile "Management of Innovative and IT Projects and Products".

The program was reviewed at the meeting of the Department of Strategic and Financial Management on March 21, 2025, protocol No. 9.

Head of Department  N.B. Grosheva