

**Federal State Autonomous Educational Institution of Higher Education "Moscow  
Institute of Physics and Technology  
(National Research University)"**

**APPROVED**  
**Head of the Phystech School of  
Biological and Medical Physics**  
**D.V. Kuzmin**

**Work program of the course (training module)**

**course:** Introduction to Biology/Введение в биологию  
**major:** Biotechnology  
**specialization:** Biomedical Engineering/Биомедицинская инженерия  
Phystech School of Biological and Medical Physics  
Center for educational programs in bioinformatics  
**term:** 1  
**qualification:** Bachelor

Semester, form of interim assessment: 2 (spring) - Grading test

Academic hours: 30 AH in total, including:

lectures: 15 AH.

seminars: 15 AH.

laboratory practical: 0 AH.

Independent work: 15 AH.

In total: 45 AH, credits in total: 1

Number of course papers, tasks: 2

Author of the program: V.A. Skobeeva, candidate of biological sciences, associate professor

The program was discussed at the Center for educational programs in bioinformatics 30.03.2024

## Annotation

The Introduction to Biology course is designed to introduce students to the basic principles of biological systematics and ecology. Familiarization with the levels of organization of living things and the manifestation of the fundamental properties of living things at the main levels of organization accessible to the naked eye: ontogenetic, population-specific, biogeocenological, biospheric. The structure and principles of ecosystem functioning are studied. Familiarization with the main types of ecosystems, the flows of matter and energy in them is carried out. The features of temperate zone ecosystems are studied. We are getting acquainted with the main families of plants, types of animals that we can meet in the vicinity of Dolgoprudny in summer practice.

### 1. Study objective

#### Purpose of the course

To form general ideas about the systematics of living organisms, the structure of ecosystems and the main organisms that we will be able to see in practice after the 1st course. To form an idea of the need to preserve the biosphere, as well as to teach a competent perception of practical problems related to biology, including human health, nature protection, overcoming the environmental crisis, to instill skills of ecological culture.

#### Tasks of the course

To provide students with instruments of navigating in systematics of eukariots. Principles of systematics, biological nomenclature. Main clades - achleplastidae, fungi, animalia. General features of main types of invertebrates, abundant in Moscow region. Vertebrates - classes and their roles in ecosystems. Concept of ecosystem, roles in ecosystem.

### 2. List of the planned results of the course (training module), correlated with the planned results of the mastering the educational program

Mastering the discipline is aimed at the formation of the following competencies:

Code and the name of the competence	Competency indicators
Gen.Pro.C-1 Apply knowledge of mathematical, physical, chemical, biological laws, patterns, and interrelation to study, analyze, and utilize biological objects and processes	Gen.Pro.C-1.1 Analyze the task in hand, outline the ways to complete it
Gen.Pro.C-3 Write scientific and/or technical (technological, innovative) reports (publications, projects)	Gen.Pro.C-3.3 Visually and graphically present scientific (scientific and technical, innovative technological) outcomes in the form of reports, scientific publications
Pro.C-1 Plan and conduct scientific experiments (in a selected subject area) and/or theoretical (analytical and simulation) research	Pro.C-1.3 Proficiency in methods of observation, description, identification and scientific classification of biological objects
Pro.C-2 Analyze research data and make scientific conclusions	Pro.C-2.3 Make scientific claims with supporting evidence for a professional audience in verbal and written form, state scientific problems and propose solutions
Pro.C-4 Critically assess the applicability of applied methods and techniques	Pro.C-4.3 Provide evidence to support the cause-effect relationship of applied concepts and models

### 3. List of the planned results of the course (training module)

As a result of studying the course the student should:

know:

- basic laws and concepts of ecology;
- concepts of systematics;
- main families of Angiosperms of moderate climate;
- main orders of insects of moderate climate;
- main order of birds and mammals of moderate climate.

be able to:

- navigate in systematics of plants and animals;
- use main concepts of ecology in application to plant and animal description;
- use guidebooks of species identification.

master:

- terminology of biological systematics;
- basic environmental concepts;
- methods of solving environmental problems;
- skills of working with literary sources;
- methods of presenting the results of their own activities using modern tools, focusing on the needs of the audience, including in the form of reports and presentations.

#### 4. Content of the course (training module), structured by topics (sections), indicating the number of allocated academic hours and types of training sessions

##### 4.1. The sections of the course (training module) and the complexity of the types of training sessions

№	Topic (section) of the course	Types of training sessions, including independent work			
		Lectures	Seminars	Laboratory practical	Independent work
1	Introduction to systematics. Types, classes, orders and families	2	2		2
2	Concept of ecosystem	2	2		2
3	Pyramid of masses and numbers in ecosystems	2	2		2
4	Plants in ecosystems. Plant communities near Dolgoprudnyi	2	2		2
5	Insects in terrestrial ecosystems	2	2		2
6	Mollusks in terrestrial and aquatic ecosystems	2	2		2
7	Vertebrates in land ecosystems	3	3		3
AH in total		15	15		15
Exam preparation		0 AH.			
Total complexity		45 AH., credits in total 1			

##### 4.2. Content of the course (training module), structured by topics (sections)

Semester: 2 (Spring)

###### 1. Introduction to systematics. Types, classes, orders and families

Basic concepts of taxonomy. Systematic categories. The hierarchical principle of systematics. The category of the species and the supraspecific taxa. Types, classes, units and families, modern databases

###### 2. Concept of ecosystem

Roles in ecosystems: producers (autotrophs), reducers, consumers. Typical composition of terrestrial (land) ecosystem

###### 3. Pyramid of masses and numbers in ecosystems

The pyramid of numbers in the ecosystem. The pyramid of numbers in terrestrial and aquatic ecosystems. The flows of matter and energy in ecosystems. Cycles of elements in ecosystems. Population growth. K and R- strategies of reproduction

#### 4. Plants in ecosystems. Plant communities near Dolgoprudnyi

Life cycles and life forms of plants. The evolution and phylogeny of angiosperms. The main families of flowering plants.

#### 5. Insects in terrestrial ecosystems

The ecological roles of insects, crustaceans, arachnids. The main (school) insect groups are diptera, Lepidoptera, Coleoptera and other groups. The main groups of insects that we can meet in the vicinity of Dolgoprudnyi.

#### 6. Mollusks in terrestrial and aquatic ecosystems

Gastropods and bivalves. The epidemiological significance of the great pond (the role of mollusks in the life cycle of parasitic worms).

#### 7. Vertebrates in land ecosystems

Amphibians, reptiles, birds, mammals of the surroundings of Dolgoprudnyi.

### **5. Description of the material and technical facilities that are necessary for the implementation of the educational process of the course (training module)**

Classroom, multimedia projector and screen.

Light microscopes, laminar box, Petri dishes, prepared specimens, refrigerator, thermomaty, sets of reagents, buffer solutions, centrifuge, autoclave.

### **6. List of the main and additional literature, that is necessary for the course (training module) mastering**

Main literature

Recommended additional literature:

1. Lisa A. Urry, Michael L. Cain, Steven A. Wasserman, Peter V. Minorsky, Jane B. Reece. Campbell Biology. — Pearson Education, 2017. — 802 p.

Additional literature

### **7. List of web resources that are necessary for the course (training module) mastering**

Not used

### **8. List of information technologies used for implementation of the educational process, including a list of software and information reference systems (if necessary)**

MS Office, MS Windows, Origin.

### **9. Guidelines for students to master the course**

The course consists of 1 lecture or 1 seminar per week, lectures and seminars alternate. The main idea of the course is to introduce students to the classification of biodiversity and the structure of ecosystems. The topic of each lecture is studied in one way or another at a subsequent seminar.

For successful completion of the course, in addition to attending lectures and laboratory classes, students are required to work independently in the amount of at least the hours specified for each section of the program. Basically, this time is devoted to the study of literature, as well as to the repetition of lecture material and preparation for intermediate tests, which are carried out for the current control over the assimilation of the material. Students who have successfully passed all forms of intermediate control are allowed to take the test in the 2nd semester

**Assessment funds for course (training module)**

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## 1. Competencies formed during the process of studying the course

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Gen.Pro.C-1 Apply knowledge of mathematical, physical, chemical, biological laws, patterns, and interrelation to study, analyze, and utilize biological objects and processes	Gen.Pro.C-1.1 Analyze the task in hand, outline the ways to complete it
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Pro.C-1 Plan and conduct scientific experiments (in a selected subject area) and/or theoretical (analytical and simulation) research	Pro.C-1.3 Proficiency in methods of observation, description, identification and scientific classification of biological objects
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Pro.C-4 Critically assess the applicability of applied methods and techniques	Pro.C-4.3 Provide evidence to support the cause-effect relationship of applied concepts and models

## 2. Competency assessment indicators

As a result of studying the course the student should:

### know:

- basic laws and concepts of ecology;
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### be able to:

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### master:

- terminology of biological systematics;
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## 3. List of typical control tasks used to evaluate knowledge and skills

Approximate list of questions for ongoing control:

1. The properties of the living.
2. Levels of organization of the living.
3. Theories of the origin of life on Earth.
4. Principles of systematics since Aristotle to now days.
5. Definition of main taxonomic categories.
6. Databases in systematics, how to use them.
7. Ecosystems. How we can identify ecosystems, borders of ecosystems.
8. Producers, reducers, consumers in land and aquatic ecosystems.
9. Freshwater ecosystems of different oxygen level.
10. Mollusks in freshwater ecosystems. Life cycle of big pond snail.
11. Insect larvae in freshwater ecosystems. Main predators and detritivores.

12. Fish in freshwater. Main orders of fish in vicinity of Dolgoprudnyi.
13. Birds of mixed forests and open spaces.
14. Mammals and their roles in ecosystems.

#### 4. Evaluation criteria

Approximate list of questions for the test on the discipline "Introduction to biology" in the 2nd semester:

Systematics as a science: scope, tasks, instruments and concepts.

Ecology as a science: scope, tasks, instruments. Components of ecosystems.

Plants in ecosystems, interactions with fungi. Main type of land plant communities in vicinity of Dolgoprudnyi.

Mollusks in land and aquatic ecosystems. Epidemiologic value of mollusks.

Insects in vicinity of Dolgoprudnyi. Main orders of insects we can meet near Dolgoprudnyi.

Frogs and their life cycle

Birds and mammals of mixed forests near Dolgoprudnyi.

Examples of test tasks:

1. Type as systematic categoria. Main requirements and examples.
2. Species and species criteria
3. Ecosystem of mixed forest – main producers, reducers, consumers.
4. Insect larva in aquatic and land ecosystems – transfer of biogenic elements
5. Snails in wildlife and agriculture
6. Snakes we can meet near Dolgoprudnyi and in Moscow region. Venomous and non-venomous snakes – how to tell them apart from distance.
7. Songbirds of mixed forests. Role of song in their life.
8. Predatory mammals of Moscow region. Skulls of predatory mammals.

Assessment excellent (10 points) - exposed to the student who showed a comprehensive, systematic, deep knowledge of the curriculum discipline, showing interest in the subject area, demonstrated the ability to confidently and creatively apply them in practice in solving specific problems, free and correct justification of decisions.

Assessment is excellent (9 points) - is exposed to the student who has shown comprehensive, systematized, deep knowledge of the curriculum of discipline and ability to confidently apply them in practice when solving specific problems, free and correct justification of the decisions made.

Assessment is excellent (8 points) - exposed to the student, who showed a comprehensive, systematic, deep knowledge of the curriculum discipline and the ability to confidently apply them in practice when solving specific problems, the correct justification of the decisions, with some shortcomings.

Rating good (7 points) - is assigned to the student if he knows the material, competently, and essentially presents it, is able to apply the acquired knowledge in practice, but has not been properly justifies the results obtained.

Rating good (6 points) is assigned to the student if he knows the material, competently, and essentially presents it, is able to apply the acquired knowledge in practice, but admits in the answer or in the task some inaccuracies.

Rating good (5 points) - is assigned to the student if he basically knows the material, competently, and essentially presents it, is able to apply the acquired knowledge in practice, but admits in the answer or in the task of quite a number of inaccuracies.

Evaluation satisfactory (4 points) - is given for student, who showed the fragmented, piecemeal nature of the knowledge is not enough for the correct formulation of the basic concepts, disorders of logical sequence in the presentation of program material, but he mastered parts of the curriculum necessary for further learning, and can apply the knowledge modeled in the standard situation.

Evaluation of satisfactory (3 points) - is given for student, who showed the fragmented, piecemeal nature of knowledge makes a mistake in the formulation of the basic concepts of violation of logical sequence in the presentation of program material, has little major parts of the curriculum necessary for further studies and work applies the knowledge gained even in the standard situation.

Assessment unsatisfactory (2 points) - exposed to the student who does not know most of the basic content of the curriculum discipline, makes blunders in the wording of the basic principles and does not know how to use the knowledge in solving typical problems.

Assessment unsatisfactory (1 point) - exposed to the student who does not know the basic content of the curriculum discipline, makes gross errors in the wording of the basic concepts of discipline and does not have the skills to solve typical practical problems.

## **5. Methodological materials defining the procedures for the assessment of knowledge, skills, abilities and/or experience**

During the test, the student is given at least 20 minutes to prepare. The ticket survey and answers to additional questions should not exceed one astronomical hour.