

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

Educational Division (faculty/institute/academy):
Institute of Ecology

COURSE SYLLABUS

Fundamentals of Environmental Science

Recommended by the Didactic Council for the Education Field for the specialization:

44.04.02 Environmental Pedagogy

The mastering of the course is carried out as part of the implementation of the main professional syllabus (Higher Education programme, specialization)

Environmental Pedagogy (master's programme)

AGREED:

Head of the Higher Education
Programme

M.M. Redina

(подпись)

«__» _____ 202__ г.

Chairperson of the Didactic
Council

(подпись)

«__» _____ 202__ г.

Head of the Department

(подпись)

«__» _____ 202__ г.

Moscow, 2022

1. Course Goals and Objectives:

The goal of the course is to obtain theoretical knowledge and practical competencies in the field of environmental problems.

Objectives:

- assimilation by students of theoretical knowledge in the main sections of ecology in accordance with state requirements for the content of the block of general natural science disciplines;

- acquisition by students of the ability to independently search for information in the field of ecology, nature conservation and its use in the process of their scientific and practical activities.

- study of the main patterns of formation and functioning of ecosystems of various ranks;
- familiarity with the basic fundamental laws of ecology;
- studying the features of the structure and dynamics of populations of organisms;
- study of the legal, social and ethical foundations of modern global ecology;
- development of ecological thinking and education of responsible attitude to the environment.

2. Course in Higher Education Programme Structure:

The course « **Fundamentals of Environmental Science** » refers to an obligatory part of block 1 of the curriculum.

Table No. 1 shows the previous and subsequent disciplines aimed at the formation of the competencies of the corresponding course in accordance with the competence matrix of EP HE.

Table 1. Previous and subsequent courses aimed at building competencies

Nr.	Competence code and title	Previous courses	Subsequent courses
General competencies			
1	GC-6 Able to determine and implement the priorities of their own activities and ways to improve it based on self-assessment	Environmental Education Research Methods of Environmental Pedagogy and Psychology Environmental Culture: Genesis and Modern Issues Computer Technologies in Education	Social Ecology Concept of Environmental Pedagogy Concept of Environmental Psychology Psychology of Environmental Behaviour Environmental Didactics Applied Ecology Fundamentals of Biodiversity Sustainable Development in the Context of Environmental Culture Green Economy and Sustainability Assessment Tools Psychology of Environmental Consciousness Psychology of Environmental Perception and Emotions Introductory Practice Teaching practice
Specialized professional competencies (type of professional activity – research, control and expert, organizational and management)			
2	SPC-2 Able to design basic and additional educational programs and develop scientific and methodological support for their implementation	-	Social Ecology Concept of Environmental Pedagogy Concept of Environmental Psychology Psychology of Environmental Behaviour Environmental Didactics Applied Ecology Fundamentals of Biodiversity Sustainable Development in the Context of Environmental Culture Green Economy and Sustainability Assessment

			Tools Psychology of Environmental Consciousness Psychology of Environmental Perception and Emotions Introductory Practice Teaching practice
3	SPC-8 Able to design pedagogical activities based on special scientific knowledge and research results		Social Ecology Concept of Environmental Pedagogy Concept of Environmental Psychology Psychology of Environmental Behaviour Environmental Didactics Applied Ecology Fundamentals of Biodiversity Sustainable Development in the Context of Environmental Culture Green Economy and Sustainability Assessment Tools Psychology of Environmental Consciousness Psychology of Environmental Perception and Emotions Introductory Practice Teaching practice

3. Requirements to Learning Outcomes:

The process of studying the course is aimed at the formation of the following competencies according to the educational standard:

General competence – 1. Able to determine and implement the priorities of their own activities and ways to improve it based on self-assessment

Specialized professional competence – 2. Able to design basic and additional educational programs and develop scientific and methodological support for their implementation

Specialized professional competence – 8. Able to design pedagogical activities based on special scientific knowledge and research results

As a result of studying the course, the student must:

Know: basic ideas of the foundations of ecology, features of the biological level of organization of matter, principles of functioning of living systems of different levels of organization, features of the current state of natural and man-made systems

Be able to: use methods of bioindication and ecological expertise of the state of natural and technogenic ecosystems, analyze private and general problems of nature management, participate in environmental management; develop recommendations for the protection of the natural environment in the work of oil and gas industry enterprises

Possess: the main methods and means of obtaining, storing, processing information (including in global and local computer networks), a computer as a means of information management

4. Course Workload and Academic Activities

The course workload of « **Fundamentals of Environmental Science** » is 4 credits.

Table 4.1. Types of academic activities during the period of the HE programme mastering

Part-time

Full-time

Types of academic activities	Total hours	Semesters							
		1	2	3	4	5	6	7	8
Contact academic hours	34	34							
Including:									
<i>Lectures</i>	17	17							
<i>Seminars (workshops/tutorials)</i>	17	17							
<i>Lab works</i>									
<i>Self-study</i>	80	80							
Evaluation and assessment (exam; pass/fail grading)	30	30							
Total course workload	hours	144	144						
	credits	4	4						

Types of academic activities	Total hours	Semesters							
		1	2	3	4	5	6	7	8
Contact academic hours									
Including:									
<i>Lectures</i>									
<i>Seminars (workshops/tutorials)</i>	12	12							
<i>Lab works</i>	-								
<i>Self-study</i>	126								
Evaluation and assessment (exam; pass/fail grading)	6								
Total course workload	hours	144							
	credits	4							

5. Course content

Table 5.1 Course modules and contents

Module	Content
1. Introduction to General Ecology	Definition, purpose, tasks of ecology. Position in the system of sciences, structure.
2. Autecology	Ecology of organisms. Factorial ecology, concept of limiting factor, tolerance, optimum. The main abiotic and biotic factors of the environment and the adaptation of organisms to them. The concept of an ecological niche. Basic living environments.
3. Population Ecology	The nature of the distribution of organisms in space. Properties of a population group. Main characteristics of populations. Population structure of the species. Sex, age, spatial and ethological structures of populations. The concept of the dynamics and homeostasis of populations. General patterns of population regulation, modifying and regulating factors, main types of population dynamics
4. Synecology	Biocenosis and ecology of communities. Community as a set of interacting populations. Types of interaction between two species. The concept of an ecosystem. Functional diagram, structure and methods for studying ecosystems. The main components of ecosystems are autotrophs, heterotrophs and decomposers. Classification of ecosystems and their main types. Energy in ecosystems. Biosphere as the highest level of organization of living matter. biogeochemical cycles. Ecological succession as a process of ecosystem development. Development of

	ecosystems in space and time. Primary and secondary succession of ecosystems.
5. Anthropogenic impacts on the environment	Modern global environmental problems. Problems of exhaustion of natural resources and environmental pollution. City ecology. Environmental protection and rational use of natural resources.

6. Classroom equipment and technology support requirements

Table 6.1 Classroom equipment and technology support requirements

Classroom for Academic Activity Type	Classroom equipment	Specialized educational/laboratory equipment and materials for mastering the module
Lecture hall (room)		
Laboratory		
Seminar room	Classroom, equipped with a set of specialized furniture; a whiteboard; a personal computer with a standard package of office programmes; a set of devices includes portable multimedia projector, laptop, projection screen, Stable wireless Internet connection. Software: Microsoft Windows, MS Office / Office 365, MS Teams, Chrome (latest stable release), Skype	
Computer lab		
For students' self-study		

7. Recommended sources for course studies

Main reading

1. Beman, J. (2010). «Energy economics in ecosystems»
2. Cleland, E. E. (2011). «Biodiversity and Ecosystem Stability»
3. Costanza, R.; Cumberland, J. H.; Daily, H.; Goodland, R.; Norgaard, R. B. (2007). «An Introduction to Ecological Economics (e-book)».
4. Odum, H. (1973). «Energy, ecology, and economics»
5. Peterson, G.; Allen, C. R.; Holling, C. S. (1998). «Ecological resilience, biodiversity, and scale»

Additional reading

1. Cavender-Bares J., Gamon, John A., Townsend, Philip A. Remote Sensing of Plant Biodiversity [Электронный ресурс] 2020. 1 с. ISBN 9783030331573 URL: https://library.oapen.org/bitstream/20.500.12657/39986/1/2020_Book_RemoteSensingOfPlantBiodiversi.pdf
2. Sakio H. Long-Term Ecosystem Changes in Riparian Forests [Электронный ресурс] 2020. 1 с. ISBN 9789811530098 URL: http://library.oapen.org/bitstream/20.500.12657/39575/1/2020_Book_Long-TermEcosystemChangesInRip.pdf

3. Biodiversity and Health in the Face of Climate Change [Электронный ресурс] / Bonn A. [и др.]. 2019. 1 с. ISBN 9783030023188 URL: <http://www.oapen.org/download/?type=document&docid=1007251>
4. Arbolino R. et al. Towards a sustainable industrial ecology: Implementation of a novel approach in the performance evaluation of Italian regions //Journal of Cleaner Production. – 2018. – Т. 178. – С. 220-236. URL: https://eprints.qut.edu.au/115357/1/JCP_QUT-eprints.pdf

Internet-based sources

1. Electronic libraries with access for RUDN students
2. Databases and search engines
www.mnr.gov.ru – site of the Ministry of Natural Resources of the Russian Federation;
<http://rpn.gov.ru/> - Federal Service for Supervision in the Sphere of Natural Resources (Rosprirodnadzor);
www.ecoindustry.ru – site of the journal “Production Ecology”;
www.unep.org – site of the United Nations Environment Programme;
www.wwf.ru – site of the World Wildlife Fund.
<http://burondt.ru/> - website of the BAT Bureau – information on the introduction of standardization based on the best available technologies
http://www.mnr.gov.ru/activity/directions/zelenye_standarty/zelenye_standarty/?sphrase_id=124597 – information on the development, application and implementation of “green standards”
http://www.mnr.gov.ru/activity/directions/natsionalnyy_proekt_ekologiya/ - information on the progress of the National Project “Ecology”

Learning toolkits for self- study in the RUDN LMS TUIS

1. Seminars for the course « **Fundamentals of Environmental Science** ».
 2. Students’ self-study which includes:
 - individual study of theoretical material on the subject of the course (links to information sources are presented in the previous sections);
 - study of additional material;
 - preparation of abstracts on the topics specified in the programme.
 3. Self-study of additional theoretical material is carried out by students on an individual basis; the list of recommended information sources is given above.
 4. Requirements for writing abstracts
- Academic ethics, respect for copyright. In the first lesson, students are informed about the need to comply with the norms of academic ethics and copyright during their studies. In particular, information is provided:

- general information about copyright;
- citation rules;
- link formatting rules.

All footnotes in the text are carefully checked and provided with “addresses”. It is not permissible to include in your work excerpts from the works of other authors without indicating this, to retell someone else’s work close to the text without referring to it, to use other people’s ideas without indicating the primary sources. This also applies to sources found on the Internet. You must specify the full site address. All cases of plagiarism must be excluded. If unjustified and incorrect borrowings are identified, the abstract is not accepted.

When preparing written works, the following must be submitted without fail: work plan; a list of used literature, drawn up in accordance with the current rules for the bibliographic description of used sources.

For the preparation of the abstract, only special relevant sources should be used. In addition to abstracts, the subject of which is related to the dynamics of any phenomena over many years, or the historical development of scientific views on any problem, sources should be used for a period of no more than 10 years.

The prepared essay should be presented at one of the classes in agreement with the teacher. Use of PowerPoint presentations (or those prepared using similar licensed or free software) is encouraged, but not required. The approximate time of the presentation is up to 15 minutes. The structure of the report and additional requirements for the quality of materials are determined by the chosen topic and are additionally discussed with a lecturer or a tutor.

8. Mid-Term Assessment and Evaluation Toolkit*

Evaluation materials for students' intermediate certification in the course of « **Fundamentals of Environmental Science** » are presented in Appendix 1 to this work programme.

*Assessment materials for the course are developed and executed in accordance with the requirements of the Regulations for the assessment and evaluation funds, approved by order of the rector dated 05.05.2016 No. 420, and include a list of competencies indicating the stages of their formation; description of indicators and criteria for assessing competencies at various stages of their formation, description of assessment scales; standard control tasks or other materials necessary to assess knowledge, skills and (or) experience of activity that characterize the stages of formation of competencies in the process of mastering the educational course; didactic materials that define the procedures for assessing knowledge, skills and (or) experience of activity that characterize the stages of competency formation).

**DEPARTMENT OF ENVIRONMENTAL SAFETY AND PRODUCT
QUALITY MANAGEMENT**

Assessment and Evaluation Fund

ON THE COURSE

Fundamentals of Environmental Science

Direction 44.04.02 Environmental Pedagogy

Programme:

Environmental Pedagogy

Qualification of the graduate –

Master of Ecology and Nature Management

Assessment and evaluation fund passport

Direction 44.04.02 Environmental Pedagogy

Course: **Fundamentals of Environmental Science**

12.1. Assessment and grading system and characteristics of the assessment scale

Controlled competence code or part	Controlled course module	Forms of control					Module points
		Classroom work			Self-study	Exam	
		Test	Control work	Class work	Seminar report		
GC-6 SPC-2 SPC-8	Introduction to General Ecology	X		8			2
GC-6 SPC-2 SPC-8	Autecology	X		12			2
GC-6 SPC-2 SPC-8	Population ecology	X		12			2
GC-6 SPC-2 SPC-8	Synecology	X		12			4
GC-6 SPC-2 SPC-8	Anthropogenic impacts on the environment	X		12			2
	Exam		15	56	15	14	

12.2 The maximum number of credits in the course is 3. At the same time, the following ratio is established between the number of points and the number of credits:

Points to credits ratio

Total points	Final assessment	Amount of credits
91	5	3
91-100	5	3
86 – 91	5 (B)	3
71-85	4 €	2
61-70	3+ (D)	1
51 – 60	3 €	1
21 – 51	2 (FX)	0
<21	2 (F)	0

Deciphering of grades is also accepted according to the specified document:

- **A: "Excellent"** - the theoretical content of the course has been fully mastered, the necessary practical skills for working with the material learned have been formed, all the educational tasks provided for by the training programme have been completed, the quality of their implementation was assessed by the number of points close to the maximum.

- **B: "Very good"** - the theoretical content of the course is mastered completely, the necessary practical skills of working with the acquired material are basically formed, all the educational tasks provided for by the training programme are completed, the quality of most of them is assessed by the number of points close to the maximum.

- **C: "Good"** - the theoretical content of the course has been mastered completely, some practical skills of working with the mastered material are not sufficiently formed, all the educational tasks provided for by the training programme have been completed, the performance quality of none of them has not been assessed with a minimum number of points, some types of tasks have been completed with mistakes.

- **D: "Satisfactory"** - the theoretical content of the course is partially mastered but the gaps are not significant, the necessary practical skills to work with the acquired material are basically formed, most of the educational tasks provided for in the training programme have been completed, some of the completed tasks may contain errors.

- **E: "Mediocre"** - the theoretical content of the course is partially mastered, some practical skills have not been formed, many of the educational tasks provided for by the training programme have not been completed, or the quality of some of them is assessed by the number of points close to the minimum.

- **FX: "Conditionally unsatisfactory"** - the theoretical content of the course has been partially mastered, the necessary practical skills have not been formed, most of the educational tasks provided for by the training programme have not been completed, or the quality of their implementation was assessed by the number of points close to the minimum; it is possible to improve the quality of completing educational tasks with additional independent work on the course material.

- **F: "Certainly unsatisfactory"** - the theoretical content of the course has not been mastered, the necessary practical skills are not formed, all the completed study tasks contain gross errors, additional independent work on the course material will not lead to any significant improvement in the quality of the study tasks.

12.3 List of competencies and their formation stages

Nr.	Competence code and title	Previous courses	Subsequent courses
General competencies			
1	GC-6 Able to determine and implement the priorities of their own activities and ways to improve it based on self-assessment	Environmental Education Research Methods of Environmental Pedagogy and Psychology Environmental Culture: Genesis and	Social Ecology Concept of Environmental Pedagogy Concept of Environmental Psychology Psychology of Environmental Behaviour Environmental Didactics Applied Ecology Fundamentals of Biodiversity Sustainable Development in the Context of Environmental Culture Green Economy and Sustainability Assessment Tools

		Modern Issues Computer Technologies in Education	Psychology of Environmental Consciousness Psychology of Environmental Perception and Emotions Introductory Practice Teaching practice
Specialized professional competencies (type of professional activity – research, control and expert, organizational and management)			
2	SPC-2 Able to design basic and additional educational programs and develop scientific and methodological support for their implementation	-	Social Ecology Concept of Environmental Pedagogy Concept of Environmental Psychology Psychology of Environmental Behaviour Environmental Didactics Applied Ecology Fundamentals of Biodiversity Sustainable Development in the Context of Environmental Culture Green Economy and Sustainability Assessment Tools Psychology of Environmental Consciousness Psychology of Environmental Perception and Emotions Introductory Practice Teaching practice
3	SPC-8 Able to design pedagogical activities based on special scientific knowledge and research results		Social Ecology Concept of Environmental Pedagogy Concept of Environmental Psychology Psychology of Environmental Behaviour Environmental Didactics Applied Ecology Fundamentals of Biodiversity Sustainable Development in the Context of Environmental Culture Green Economy and Sustainability Assessment Tools Psychology of Environmental Consciousness Psychology of Environmental Perception and Emotions Introductory Practice Teaching practice

12.4. Typical control tasks or other materials necessary to assess knowledge, skills and (or) experience of activities, characterizing the formation stages of competencies in the process of mastering the educational course

Questions to prepare for certification

1. Object and subject of general ecology. Place in the system of sciences.
2. Autecology and synecology. Levels of organization of living matter.
3. Criteria for living systems. The main directions of general ecology.
4. The concept of the environmental factor. Classifications.
5. Tolerance. Zones of optimum and minimum.
6. The concept of the limiting factor. The law of factor compensation.
7. Climatic factors. Light.
8. Climatic factors. Temperature.
9. Climatic factors. Moisture and wind.

10. Edaphic factors.
11. Hydrological factors. ecological regions of the ocean.
12. Orographic factors.
13. Biotic factors. Symbiosis.
14. Biotic factors. Antibiosis.
15. Species, subspecies, population. Population types.
16. Static characteristics of the population.
17. Dynamic characteristics of the population. Types of population dynamics.
18. Urban ecosystems. Geological structure, relief, soils.
19. Urban ecosystems. Atmosphere, ground and surface waters.
20. Urban ecosystems. Soils, vegetation, animal population.
21. Urban ecosystems. Physical impact on the environment.
22. Bioindication of the state of the environment.
23. Spatial and age structure of the population.
24. Characteristics of the main environments of life
25. Classifications of natural resources
26. Classification of environmental pollution
27. MPC concept

12.4. Didactic materials defining the procedures for assessing and evaluating knowledge, skills, and activity skills, characterizing the formation stages of competencies.

The assessment and evaluation of knowledge, skills and abilities is carried out by using the components of the WCF presented in paragraphs 12.1-12.3, 12.4 in accordance with the sequence of acquisition of competencies indicated in table 12.2.

The programme is compiled in accordance with the requirements of the ES HE RUDN / FGOS HE.

Developers:

Leading specialist of the Institute of Ecology	signature	O.E.Polynova
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Professor of the Department of Environmental Safety and Product Quality Management	signature	M.M. Redina
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**Head of the Higher Education
program**

Associate Professor of the Department of Foreign Languages	signature	Y.L.Zakirova
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Educational department	signature	initials>surname
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