

Federal State Autonomous Educational Institution of Higher Education
"Peoples' Friendship University of Russia"

Faculty of ecology
Recommended by ISSC

THE WORKING PROGRAM OF THE DISCIPLINE

Title of the discipline STABILITY OF NATURAL SYSTEMS

Recommended for the direction of training / specialty

05.06.01 EARTH SCIENCES

Focus of the program (profile)

Ecology: Modern environmental studies

1. Goals and objectives of the discipline:

The objectives of the discipline are the formation of basic competencies BC-1, 3, 4; general professional competencies 1, 2; professional competencies (PC1-4), including:

- the formation of students' systemic ideas about the theoretical and methodological foundations of the analysis and modeling of the sustainability of natural systems;
- the formation of ideas about the mechanisms of sustainability of environmental components, approaches to their identification and regulation on this basis of anthropogenic activities;
- the formation of ideas and skills to regulate the stability of natural systems based on the theoretical knowledge gained.

To achieve this goal in the process of teaching the course, the following tasks are to be solved:

- formation of ideas about the sustainability of natural systems;
- creation of systemic ideas about the structure of environmental regulation, international experience in environmental regulation and harmonization of environmental standards;
- analysis of the current system of environmental regulation for various areas of nature management;
- formation of ideas about environmental regulation as a basis for economic regulation of environmental management.

2. Place of discipline in the structure of the educational program:

Discipline refers to the basic part of the curriculum.

Table 1 shows the previous and subsequent disciplines aimed at the formation of the competencies of the discipline in accordance with the matrix of competencies

Table 1

Prior and subsequent disciplines aimed at the formation of competencies

| № п/п | Code and name of competency | Previous disciplines | Subsequent disciplines (groups of disciplines) |
|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|-------------------------------------------------------------------------------------------|
| Basic competencies | | | |
| | BC-1: To own the ability to critically analyze and evaluate modern scientific achievements, generate new ideas in solving research and practical problems, including in interdisciplinary fields | | Experimental Ecotoxicology Environmental Management Environmental Impact Assessment |
| | BC-3: To have the willingness to participate in the work of Russian and international research teams to solve scientific and scientific-educational problems | | Experimental Ecotoxicology Environmental Management Environmental Impact Assessment |
| General professional competencies | | | |
| | GPC-1 To own the ability to independently carry out research activities in the relevant professional field using modern research methods and information and communication technologies | | Strategic environmental assessment Urban environment |
| | GPC-2 To have a willingness to teach in the main educational programs of higher education | | Strategic environmental assessment Urban environment |
| Professional competencies | | | |

| | | | |
|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-------------------------------------------------------------------------------------------|
| | PC-1 To own the theoretical knowledge on modern issues of scientific-subject area (Environmental sciences: Stability of natural systems, Strategic environmental assessment, Urban environment, Experimental Ecotoxicology, Environmental Management, Environmental Impact Assessment) in the direction of the program and be able to use it for scientific, practical and pedagogical purposes | | Experimental Ecotoxicology Environmental Management Environmental Impact Assessment |
| | PC-2 To be able to diagnose problems of nature protection in modern cities, assess the impact of planned facilities or other forms of economic activity and develop practical recommendations for environmental protection and sustainable development in the urban environment based of the environmental assessments, environmental management approaches and knowledge of responses of organisms on the pollution (environmental toxicology) | | Experimental Ecotoxicology Environmental Management Environmental Impact Assessment |
| | PC-3 To be able to analyze and assess the impact of the environment on human health and life in the conditions of modern cities as well as to organize environmental protection and human health protection | | Environmental Management Environmental Impact Assessment |
| | PC-4 To be able to organize and manage research, research and production, expert-analytical work and pedagogical activities using advanced knowledge in the field of training | | Strategic environmental assessment Urban environment |

3. Requirements for the results of mastering the discipline:

The process of studying the discipline is aimed at the formation of the following competencies:

BC-1: To own the ability to critically analyze and evaluate modern scientific achievements, generate new ideas in solving research and practical problems, including in interdisciplinary fields

BC-3: To have the willingness to participate in the work of Russian and international research teams to solve scientific and scientific-educational problems

GPC-1 To own the ability to independently carry out research activities in the relevant professional field using modern research methods and information and communication technologies

GPC-2 To have a willingness to teach in the main educational programs of higher education

PC-1 To own the theoretical knowledge on modern issues of scientific-subject area (Environmental sciences: Stability of natural systems, Strategic environmental assessment, Urban environment, Experimental Ecotoxicology, Environmental Management, Environmental Impact Assessment) in the direction of the program and be able to use it for scientific, practical and pedagogical purposes

PC-2 To be able to diagnose problems of nature protection in modern cities, assess the impact of planned facilities or other forms of economic activity and develop practical recommendations for environmental protection and sustainable development in the urban environment based of

the environmental assessments, environmental management approaches and knowledge of responses of organisms on the pollution (environmental toxicology)

PC-3 To be able to analyze and assess the impact of the environment on human health and life in the conditions of modern cities as well as to organize environmental protection and human health protection

PC-4 To be able to organize and manage research, research and production, expert-analytical work and pedagogical activities using advanced knowledge in the field of training

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

Know: the theoretical foundations of environmental regulation; international practice of development and harmonization, as well as the application of environmental standards; domestic practice of developing and applying environmental standards in the field of protecting the atmosphere, surface and underground hydrospheres, soils and lands, bioresources, industrial and municipal waste management, introducing the best available technologies, environmental and economic justification of projects based on existing and developing environmental standards.

Be able to: conduct a critical analysis of practical developments and research results on the above issues; apply the obtained theoretical knowledge to the planning, design, control and examination of environmental protection projects; to modernize the existing system of environmental regulation.

To have skills: in analyzing the need for environmental protection measures based on the application of environmental standards, skills in the selection and application of indicators for environmental impact assessment and forms of environmental control based on environmental standards.

4. The volume of discipline and types of educational work

| Type of study | Hours | Course | |
|--------------------------|----------|--------|-------|
| | | Sem 1 | Sem 2 |
| Class hours (total) | 80 | | |
| <i>Including:</i> | - | | |
| Lectures | | | |
| Practical training | 80 | 40 | 40 |
| Laboratory works | 0 | | |
| Independent work (total) | 64 | 23 | 5 |
| Credit system | час | 144 | 72 |
| | зач. ед. | 4 | 2 |

5. The content of the discipline

5.1 the content of the sections of the discipline

| № п/п | Course units (Topics) | Course units (Topics) Outline |
|----------|------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Part 1. General concepts of the natural systems stability | Sustainability of the natural systems and their development trajectory. Environmental norms as an instrument of nature management. Types of the standards. Nature management and environmental safety. |
| 2. | Part 2. Resistance of the air environment to contamination | Factors of the pollution and self-purification of the atmosphere. Main models of the atmosphere pollution. Norms of the atmospheric quality: approaches to the setting of norms and examples. Regulation of the atmospheric pollution. |

| | | |
|----|-----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3. | <i>Part 3. Stability of the surface hydrosphere to pollution and depletion</i> | Factors of the pollution and self-purification of the water bodies. Basic models of the pollution of surface water flows. Norms of water quality |
| 4. | <i>Part 4. Resistance of the underground hydrosphere to pollution and depletion</i> | Based on systemic principles, the possibilities of ecological regulation of technogenic impacts on the underground hydrosphere are considered. Approaches to assessing the stability of hydrogeological systems and the main processes of transformation of pollutants in aquifers are considered. The experience of impact assessment based on limiting factors in various areas of groundwater use in industry and agriculture is generalized. Information on the most promising methods and technologies for protecting the underground hydrosphere from pollution and depletion is provided. |
| 5. | <i>Part 5. Stability of soils</i> | Soil quality : assessment, models, approaches to justification of norms, types of norms, examples. |
| 6. | <i>Part 6. Resistance of the living organisms to the environmental pollution and destruction: bioindication</i> | Basic concepts of bioindication. Practical examples: use of biotests for the development of standards and for the environmental quality control. Main opportunities, perspectives and restrictions |
| 7. | <i>Part 7. Stability of natural systems and nature management</i> | Environmental regulation system as a base of the nature management and environmental management system. Justification of environmental norms for the support of environmental systems quality. |

5.2* Sections of disciplines and types of classes

| № п/п | Name | Lectures | Practical lessons | Indep. work | Hours total |
|-------|-----------------------------------------------------------------------------------------------------------------|----------|-------------------|-------------|-------------|
| 1. | Part 1. General concepts of the natural systems stability | 0 | 12 | 4 | 16 |
| 2. | <i>Part 2. Resistance of the air environment to contamination</i> | 0 | 12 | 4 | 16 |
| 3. | <i>Part 3. Stability of the surface hydrosphere to pollution and depletion</i> | 0 | 12 | 4 | 16 |
| 4. | <i>Part 4. Resistance of the underground hydrosphere to pollution and depletion</i> | 0 | 10 | 4 | 14 |
| 5. | <i>Part 5. Stability of soils</i> | 0 | 12 | 4 | 16 |
| 6. | <i>Part 6. Resistance of the living organisms to the environmental pollution and destruction: bioindication</i> | 0 | 12 | 4 | 16 |
| 7. | <i>Part 7. Stability of natural systems and nature management</i> | 0 | 10 | 4 | 14 |
| 8. | | | 80 | 28 | 144 |

6. Laboratory practice (if applicable) - NO

7. Practical classes (seminars)

| No | Unit | Topics | Hours |
|----|------------------------------|-------------------------------|-------|
| 1. | <i>Course units (Topics)</i> | Course units (Topics) Outline | |

| | | | |
|----|-----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 2. | Part 1. General concepts of the natural systems stability | Sustainability of the natural systems and their development trajectory. Environmental norms as an instrument of nature management. Types of the standards. Nature management and environmental safety. | 12 |
| | <i>Part 2. Resistance of the air environment to contamination</i> | Factors of the pollution and self-purification of the atmosphere. Main models of the atmosphere pollution. Norms of the atmospheric quality: approaches to the setting of norms and examples. Regulation of the atmospheric pollution. | 12 |
| | <i>Part 3. Stability of the surface hydrosphere to pollution and depletion</i> | Factors of the pollution and self-purification of the water bodies. Basic models of the pollution of surface water flows. Norms of water quality | 12 |
| | <i>Part 4. Resistance of the underground hydrosphere to pollution and depletion</i> | Based on systemic principles, the possibilities of ecological regulation of technogenic impacts on the underground hydrosphere are considered. Approaches to assessing the stability of hydrogeological systems and the main processes of transformation of pollutants in aquifers are considered. The experience of impact assessment based on limiting factors in various areas of groundwater use in industry and agriculture is generalized. Information on the most promising methods and technologies for protecting the underground hydrosphere from pollution and depletion is provided. | 10 |
| | <i>Part 5. Stability of soils</i> | Soil quality : assessment, models, approaches to justification of norms, types of norms, examples. | 12 |
| | <i>Part 6. Resistance of the living organisms to the environmental pollution and destruction: bioindication</i> | Basic concepts of bioindication. Practical examples: use of biotests for the development of standards and for the environmental quality control. Main opportunities, perspectives and restrictions | 12 |
| | <i>Part 7. Stability of natural systems and nature management</i> | Environmental regulation system as a base of the nature management and environmental management system. Justification of environmental norms for the support of environmental systems quality. | 10 |

9. Material and technical support of the discipline:

An audience equipped with multimedia equipment and a personal computer with a standard office suite.

9. Information support of discipline

When studying the discipline, traditional information technologies are used to represent the theoretical part of the material by the teacher (PowerPoint presentations).

As additional material, materials of a massive open online course developed by the author of this program - "Environmental standards and norms for the sustainability" (Environmental standards and norms for sustainable development), available at <https://www.openlearning.com/courses/environmental-standards-and-norms-for-the-sustainability/HomePage>

a) software

b) databases, reference and search engines

www.mnr.gov.ru - website of the Ministry of Natural Resources of the Russian Federation;

<http://rpn.gov.ru/> - Federal Service for Supervision of Natural Resources Use (Rospirodnadzor);

www.ecoindustry.ru - site of the journal "Production Ecology";

www.unep.org - website of the United Nations Environment Program;

www.wwf.ru - WWF website.

<http://burondt.ru/> - BAT website - information on the implementation of regulation 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 implementation of the Ecology National Project

www.epa.gov - United States Environmental Protection Agency | US EPA

www.eea.europa.eu - European Environment Agency's home page

Educational and methodological support of the discipline:

Supporting and additional sources

1. Хаустов А.П., Редина М.М. Нормирование и снижение загрязнений окружающей среды. М.: Юрайт, 2017. – 364 с. - Представлен в УНИБЦ РУДН и доступен на сайте издательства Юрайт по адресу: https://biblio-online.ru/viewer/normirovanie-i-snizhenie-zagryazneniya-okruzhayuschey-sredy-432790?share_image_id=#page/1
2. *Environmental standards and norms for sustainable development*), available at <https://www.openlearning.com/courses/environmental-standards-and-norms-for-the-sustainability/HomePage>

11. Guidelines for students in the development of the discipline

Independent work of students 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 presented in the course "Environmental standards and norms for the sustainability" (paragraph 9 of this program);
- preparation of essays on the topics specified in the program.

11.1. Self-study of additional theoretical material is carried out by students in an individual mode; The list of recommended information sources is given above.

11.2. Guidance on how to learn more about Environmental standards and norms for the sustainability is available at www.mooc

11.3. Requirements for writing essays

Academic ethics, copyright compliance. In the first lesson, students are informed about the need to comply with academic ethics and copyright during the training. In particular, information is provided:

- general copyright information;
- citation rules;
- rules for registration of links

All footnotes in the text are carefully verified and provided with "addresses". It is not permissible to include extracts from the works of other authors in this work without indicating this, retelling someone

else's work close to the text without reference to it, using someone else's ideas without specifying the source. This also applies to sources found on the Internet. You must specify the full address of the site. All cases of plagiarism should 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; list of used literature, drawn up in accordance with the current rules of the bibliographic description of the sources used.

For the preparation of the abstract, only special relevant sources should be used. In addition to abstracts, the subject of which is connected with 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 not more than 10 years.

A prepared essay should be presented at one of the classes in agreement with the teacher. Using PowerPoint presentations (or prepared using similar licensed or freeware programs) is encouraged, but not required. Estimated time of the report 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 the teacher.

12. Fund of assessment tools for intermediate certification of students in the discipline (module)

Materials for assessing the level of mastering the educational material of the discipline "Stability of natural systems" (evaluation materials), including a list of competencies indicating the stages of their formation, a description of indicators and criteria for evaluating competencies at various stages of their formation, a description of the assessment scales, typical control tasks or other materials necessary to assess knowledge, skills, skills and (or) experience of activity, characterizing the stages of the formation of competencies in the process of mastering the educational program, methodological materials that determine the procedures for assessing knowledge, skills, skills and (or) experience of activities that characterize the stages of the formation of competencies are developed in full and are available for students on the discipline page at TUIS RUDN.

The program has been drawn up in accordance with the requirements of the ES of HE RUDN University.

Developer

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