

*Federal state autonomous educational institution of higher professional education
"People's Friendship University of Russia"*

Faculty of ecology

Recommended by the methodological council
on specialties and directions

DISCIPLINE PROGRAM

Title of the discipline Monitoring of urban environment

Recommended for the direction of training / specialty

05.06.01 Earth Sciences

Direction of the program (profile)

Ecology: Modern environmental studies

1. Goals and objectives of the discipline:

- the formation of students' systemic ideas about the theoretical and methodological foundations of the analysis and modeling of the sustainability of socio-ecological and economic systems;
- formation of ideas about the mechanisms of mutual influence of social, economic and environmental factors, approaches to their identification and regulation on the basis of anthropogenic activity;
- formation of ideas and skills for planning the development of socio-ecological and economic systems at different levels, from the enterprise to the region, in order to implement sustainable development.

To achieve this goal in the course of teaching the course, it is necessary to solve the following tasks:

- formation of ideas about the sustainability of socio-ecological and economic systems;
- analysis of existing environmental design tools and standards for various areas of environmental management;
- formation of ideas about strategic environmental assessment as a tool of environmental design for sustainable development of territories;
- formation of ideas about approaches and methods of strategic environmental assessment of territories and enterprises.

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

The discipline "Monitoring the urban environment" refers to the optional part of the Discipline (modules) optional 3 (DV.3) Table 1 shows the previous and subsequent disciplines aimed at the formation of discipline competencies in accordance with the competence matrix of EP HE,

Table No. 1

Prior and subsequent disciplines aimed at the formation of competencies

№ п/п	Code and name of competence	Preceding disciplines	Subsequent disciplines (groups of disciplines)
Basic competencies			
BC-1	the ability to critically analyze and evaluate modern scientific achievements, generate new ideas when solving research and practical problems, including in interdisciplinary fields	Scientific research methodology Stability of natural systems	Thesis preparation
BC-2	the ability to critically analyze and evaluate modern scientific achievements, generate new ideas when solving research and practical problems, including in interdisciplinary fields	Scientific research methodology Stability of natural systems	
BC-3	the ability to critically analyze and evaluate modern scientific achievements, generate new ideas when solving research and practical problems, including in interdisciplinary fields	Scientific research methodology Stability of natural systems	
BC-5	the ability to plan and solve problems of one's own professional and personal development	Stability of natural systems	
General professional competencies			
GPC-1	the ability to independently carry out research activities in the relevant professional field using modern research methods and information and communication technologies	Stability of natural systems	Управление окружением Оценка воздействия на окружающую среду
GPC-2	the ability to independently carry out research activities in the relevant professional field using modern research methods and information and communication technologies	Stability of natural systems	Управление окружением Оценка воздействия на окружающую среду

Профессиональные компетенции			
PC-1	Possess a modern scientific subject area of knowledge according to the focus of the program and be able to use it for scientific, practical and pedagogical purposes	Scientific research methodology	Thesis preparation
PC -2	To be able to diagnose issues of environmental protection, to make the impact assessment of building projects and other forms of anthropogenic activities to give recommendations on nature preserving and sustainable development maintenance.	Stability of natural systems	Environmental Management Environmental Impact Assessment
PC -3	To be able to make analysis and assessment of nature influence on health and human livelihood	Stability of natural systems	Environmental Management Environmental Impact Assessment
PC -4	To be able to organize and control scientific, research and manufacturing, expert and analytical work and educational work with the use of deepen knowledge in the field of program track	Scientific research methodology	Thesis preparation

3. Требования к результатам освоения дисциплины:

Процесс изучения дисциплины направлен на формирование следующих компетенций

<i>General professional competencies</i>	
способностью самостоятельно осуществлять научно-исследовательскую деятельность в соответствующей профессиональной области с использованием современных методов исследования и информационно коммуникационных технологий	GPC-1
способностью самостоятельно осуществлять научно-исследовательскую деятельность в соответствующей профессиональной области с использованием современных методов исследования и информационно коммуникационных технологий	GPC-2
<i>Basic competencies</i>	
способностью к критическому анализу и оценке современных научных достижений, генерированию новых идей при решении исследовательских и практических задач, в том числе в междисциплинарных областях	BC-1
способностью к критическому анализу и оценке современных научных достижений, генерированию новых идей при решении исследовательских и практических задач, в том числе в междисциплинарных областях	BC-2
способностью к критическому анализу и оценке современных научных достижений, генерированию новых идей при решении исследовательских и практических задач, в том числе в междисциплинарных областях	BC-3
способностью планировать и решать задачи собственного профессионального и личностного развития	BC-5
<i>Professional competencies</i>	
Владеть современной научно предметной областью знаний по направленности программы и уметь использовать её в научных, практических и педагогических целях	PC-1
Уметь диагностировать проблемы охраны природы, проводить оценку воздействия планируемых сооружений или иных форм хозяйственной деятельности и разрабатывать практические рекомендации по охране природы и обеспечению устойчивого развития	PC-2
Уметь проводить анализ и оценку воздействия окружающей среды на здоровье и жизнедеятельность человека	PC-3
Уметь осуществлять организацию и управление научно-исследовательскими, научно-производственными, экспертно-аналитическими работами и педагогической деятельностью с использованием углубленных знаний в области направления подготовки	PC-4

As a result of studying the discipline PhD student must:

Know: theoretical and methodological foundations of analysis and modeling of the sustainability of socio-ecological and economic systems; mechanisms of mutual influence of social, economic and environmental factors, approaches to their identification and regulation based on anthropogenic activities

be able to: conduct a critical analysis of the development of socio-ecological and economic systems at different levels, from the enterprise to the region, plan the development of socio-ecological and economic systems in order to ensure sustainable development.

Have skills: of analysis of the development of socio-ecological and economic systems at different levels; in the application of various approaches and methods of strategic environmental assessment of territories and enterprises.

4. The volume of disciplines and types of training work

Total labor discipline is 4 credits.

Type of study	Hours	Semester			
Class hours (total)	30	4			
<i>Including:</i>	-	-	-	-	-
Lectures	10	10			
Practical training	20	20			
Laboratory works					
Independent work (total)					
Class hours (total)	87	87			
Credit system	час	144	144		
	зач. ед.	4	4		

5. Contents

5.1. Contents sections

Section of the discipline	In This section
Part 1. Principles of organizing atmospheric air monitoring: the main types of monitoring implemented in the Republic of Belarus, their goals and objectives, monitoring parameters, main results.	1. The specifics of the urban atmosphere. The basic principles of environmental monitoring: integrity, systematicity, adequacy to existing threats and risks, adequacy to the needs of various information groups, unification. The structure of the environmental monitoring system: monitoring system; databases, analytical block, information block; environment control unit. 2. Requirements for air control systems: 3. Types of air monitoring: - Monitoring of atmospheric air within NMHS (chemical, radiation, ozone, transboundary); - Integrated satellite and ground monitoring of atmospheric air pollution; - Functional links with meteorological and sanitary monitoring. 4. Monitoring parameters, monitoring network: Composition of the AB condition and pollution monitoring network in the Republic of Belarus; Basic and specific observable parameters. 5. Chemical composition of precipitation: - Observation network; - Observable parameters. 6. Air quality: - Methods of assessment; - Dynamics of air quality in the Republic of Belarus. 7. Cross-border transfer: - Programs of cross-border transfers; - Parameters for monitoring transboundary transfers. 8. Methods for monitoring atmospheric air: - Types of observations: discrete, continuous, stationary, route; - Methods for measuring atmospheric concentrations; - Methods for collecting, processing, storing and presenting information. 9. Main results and development trends of the atmospheric air monitoring system: Modern trends in the development of atmospheric air monitoring.
Part 2. Monitoring of water quality.	Introduction: the main problems of water quality monitoring in urban areas. 1. CHEMICAL COMPOSITION OF WATER. Classification of the composition of natural waters. 2. HYDROCHEMICAL ANALYSIS OF WATER. Methods for determining the composition of water. 3. HYDROBIOLOGICAL ANALYSIS OF SURFACE WATER. Hydrobiological analysis methods. Criteria and significance of hydrobiological analysis. 4. PROPERTIES AND PROCESSES OF RADIONUCLIDE TRANSFER IN NATURAL WATER. Organization of wastewater and experimental catchments to assess the removal and washout of radionuclides from river catchments. 5. PHYTOBIOLOGICAL ASPECTS OF RESERVOIR

	REHABILITATION. Phytobiological aspects of water body rehabilitation. 6. RADIOACTIVE WATER POLLUTION AND WATER PROTECTION PLANNING. Basic principles of organization of radiation monitoring of surface waters: selection of observation points, frequency of observations, determined parameters.
Part 3. Monitoring of soil quality.	1 FUNDAMENTALS OF SOIL MONITORING Specificity of urban soils. The purpose and objectives of land monitoring. Land monitoring methodology. The concept of state monitoring of land in Belarus. Monitoring in different countries of the world. 2 METHODOLOGICAL BASIS OF SOIL MONITORING Current state of soil and land resources Land degradation and industrial pollution Background land monitoring. Background monitoring features. Monitoring observation network. Controlled indicators. Monitoring of the land fund. Principles of organizing observations and selection of objects. Content of monitoring observations. Assessment of observation results Monitoring of technologically contaminated soils. Principles of organizing monitoring observations on technologically contaminated lands. Organization of work, selection of objects. Controlled indicators. Assessment of the results of observations during the monitoring of technogenically contaminated soils. 3. USE OF MAN-GENERALLY CONTAMINATED LAND. Principles and features of the use of land contaminated with radionuclides. Measures to reduce the transfer of radionuclides from soil to plants and crop production.
Part 4. Fundamentals of flora and fauna monitoring.	The background state of the environment. Impacts and loads on the elements of the biosphere. Permissible and maximum permissible shocks and loads. Threshold of influence on biological systems. Environmental sustainability and stability. Ecological reserve and ecological capacity of the system. Critical link. Biodiversity as an indicator of ecosystem sustainability.

5.2. Sections of disciplines and occupations

№ п/п	Sections of disciplines and occupations	lections	PT	IW	hours
1.	Part 1. Principles of organizing atmospheric air monitoring: the main types of monitoring implemented in the Republic of Belarus, their goals and objectives, monitoring parameters, main results.	4	5	27	36
2.	Part 2. Monitoring of water quality.	2	5	20	27
3.	Part 3. Monitoring of soil quality.	2	5	20	27
4.	Part 4. Fundamentals of flora and fauna monitoring.	2	5	20	27
		10	20	87	144

5. Laboratory workshop (if any) – NO

6. Practical trainings (seminars)

№ п/п	Sections of disciplines and occupations	In This section	Hours
1.	Part 1. Principles of organizing atmospheric air monitoring: the main types of monitoring implemented in the Republic of Belarus, their goals and objectives, monitoring parameters, main results.	Comprehensive satellite and ground monitoring of atmospheric air pollution; - Functional links with meteorological and sanitary monitoring. Modern trends in the development of atmospheric air monitoring.	2
2.	Part 2. Monitoring of water	Basic principles for organizing surface water	4

	quality.	monitoring: selection of observation points, frequency of observations, determined parameters.	
3	Part 3. Monitoring of soil quality.	1 FUNDAMENTALS OF SOIL MONITORING Specificity of urban soils. The purpose and objectives of land monitoring. Background monitoring features. Monitoring observation network. Controlled indicators. Monitoring of the land fund. Principles of organizing observations and selection of objects. Content of monitoring observations. Evaluation of observation results	2
4	Part 4. Fundamentals of flora and fauna monitoring.	The background state of the environment. Impacts and loads on the elements of the biosphere. Permissible and maximum permissible shocks and loads. Environmental sustainability and stability. Ecological reserve and ecological capacity of the system.	4

8. Material and technical support of the discipline:

An auditorium equipped with multimedia equipment and a personal computer with a standard package of office programs.

9. Information support of the discipline

When studying the discipline, traditional information technologies are used to present the theoretical part of the material by the teacher (PowerPoint presentation). As additional material, materials are offered from a massive open online course developed by the author of this program - "Environmental standards and norms for the sustainability", <https://www.openlearning.com/courses/environmental-standards-and-norms-for-the-sustainability/HomePage>

a) software

MSWindows; MSOffice

b) databases, reference and search systems

www.mnr.gov.ru – сайт Министерства природных ресурсов РФ;

<http://rpn.gov.ru/> – Федеральная служба по надзору в сфере природопользования (Росприроднадзор);

www.ecoindustry.ru – сайт журнала «Экология производства»;

www.unep.org – сайт программы организации объединенных наций по окружающей среде;

www.wwf.ru – сайт Всемирного фонда дикой природы.

<http://burondt.ru/> - сайт бюро НДТ – информация о внедрении нормирования на основе наилучших доступных технологий

http://www.mnr.gov.ru/activity/directions/zelenye_standarty/zelenye_standarty/?sphrase_id=124597 – информация о разработке, применении и внедрении «зеленых стандартов»

http://www.mnr.gov.ru/activity/directions/natsionalnyy_proekt_ekologiya/ - информация о ходе реализации Национального проекта «Экология»

10. The educational-methodical and informational support of the discipline:

a) main literature

1) J. F. G. Mendes, L. T. Silva, P. Ribeiro¹ & A. Magalhães An urban environmental monitoring and information system Air Pollution XVII 111 www.witpress.com, ISSN 1743-3541 (on-line) ©2009 WIT Press WIT Transactions on Ecology and the Environment, Vol 123, doi:10.2495/AIR090101 (PDF) An urban environmental monitoring and information system. Available from: https://www.researchgate.net/publication/271449413_An_urban_environmental_monitoring_and_information_system [accessed Jun 07 2021].

2) John J. Cohn (Author), Sidney Draggan (Author), Richard Morrison Environmental Monitoring, Assessment, and Management: The Agenda for Long-Term Research and Development

3) Gerardus Blokdyk Environmental Monitoring and Assessment Second Edition Paperback, 5STARCOoks, 2018, 294p.

4) Frank R. Burden, Ulrich Foerstner, Ian D. McKelvie, Alex Guenther Environmental Monitoring Handbook The McGraw-Hill Companies, Inc 2002

5) Meng Gao, Sunita Verma, Divya Prakash, Suriyanarayanan Sarvajayakesavalu Advances in Environmental Monitoring and Assessment. Comparison of Various Classification Techniques for Satellite Data, IntechOpen, 2019

6) Guidebook for Monitoring and Evaluating Ecosystem-based Adaptation Interventions Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) Berlin and Bonn, 2020, 84p

7) **Гидрологический мониторинг Республики Беларусь** / Министерство природных ресурсов и охраны окружающей среды Республики Беларусь, Департамент по гидрометеорологии ГУ "Республиканский гидрометеорологический центр"; [под общей редакцией А. И. Полищука и Г. С. Чекана]. – Минск: Книгазбор, 2009. – 267 с.

8) **Дрозд, Василий Викентьевич.** Водные ресурсы Беларуси: методология, структура, оценка, прогноз / В.В. Дрозд; [в авторской редакции]. – Минск: Ковчег, 2010. – 200, [1] с.: табл., карты, ил., портр.

9) **Дромашко, Сергей Евгеньевич.** Биотестирование - составной элемент системы оценки состояния окружающей среды : учебно-методическое пособие / С. Е. Дромашко, С. Н. Шевцова ; ГУО "Институт подготовки научных кадров Национальной академии наук Беларуси", Кафедра естественно-научных дисциплин. – Минск : ИПНК, 2012. – 82 с. : цв. ил., табл.

10) **Дромашко, Сергей Евгеньевич.** Ресурсы растительного и животного мира, их мониторинг, рациональное использование и охрана : учебно-методическое пособие / С. Е. Дромашко, А. М. Слуквин ; ГУО "Институт подготовки научных кадров Нац. акад. наук Беларуси", Кафедра естественно-научных дисциплин. – Минск : ИПНК НАН Беларуси, 2012. – 77 с. : ил., цв. ил., карты, табл.

11) Другов, Ю. С. **Анализ загрязненной воды** : практическое руководство / Ю. С. Другов, А. А. Родин. — Москва : БИНОМ. Лаборатория знаний, 2012. — 678 с.

12) Методика проведения мониторинга растительного мира в составе национальной системы мониторинга окружающей среды Республики Беларусь / [авторы-составители: А.В. Пугачевский и др.; научный редактор А.В. Пугачевский]; Национальная академия наук Беларуси, Государственное научное учреждение "Институт экспериментальной ботаники им. В.Ф. Купревича НАН Беларуси". – Минск: Право и экономика, 2011. – 164 с.

б) additional literature

1. COUNCIL DIRECTIVE of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment (85/337/EEC) <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31985L0337:EN:HTML>

2. DIRECTIVE 2001/42/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 June 2001 on the assessment of the effects of certain plans and programs on the environment <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32001L0042&from=EN>

3. Policy, plan, and program environmental assessment in England, the Netherlands, and Germany: Practice and prospects // Article in Environment and Planning B Planning and Design March 2002 5. <http://eco-expertise.org/obshhestvennaya-ekologicheskaya-eksperti/strategicheskoy-ekologicheskoy-otsenki/>

4. https://youtu.be/KTHKqx-C_C8 - SEA video

11. Methodical instructions for students on mastering the discipline (module)

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 abstracts on the topics specified in the program.

11.1. Independent study of additional theoretical material is carried out by students on an individual basis; the list of recommended information sources is given above.

11.2. Recommendations for mastering the supplementary material of the course "Environmental standards and norms for the sustainability" can be found on the course web page

11.3. Requirements for writing abstracts Academic ethics, copyright compliance. In the first lesson, students are informed about the need to comply with the norms of academic ethics and copyright in the course of their studies. In particular, information is provided: - general information about copyright; - citation rules; - rules of link formatting 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 indicate 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 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 "Monitoring of urban environment" (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.

Head of the Program
Head of the department
Applied ecology



M.M. Redina