

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

**Institute of Environmental Engineering**

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(наименование основного учебного подразделения (ОУП)-разработчика ОП ВО)

**COURSE SYLLABUS**

**Monitoring of natural and man-made systems/ Мониторинг природно-  
техногенных систем**

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(наименование дисциплины/модуля)

**Recommended by the Methodological Council for the Education Field:**

**05.04.06 Ecology and nature management**

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(код и наименование направления подготовки/специальности)

**The discipline is mastered within the framework of the main professional higher education program:**

**УПРАВЛЕНИЕ ПРИРОДОПОЛЬЗОВАНИЕМ / NATURE MANAGEMENT**

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(наименование (профиль/специализация) ОП ВО)

## 1. COURSE GOALS

The course goal is to familiarization with theoretical basics and practical approaches of the environmental monitoring methodologies and techniques and industrial monitoring methods for modern enterprises and systems of nature management.

## 2. LEARNING OUTCOMES

The mastering of the discipline “Monitoring of natural and man-made systems/ Мониторинг природно-техногенных систем” is aimed at the formation of the following competencies (parts of competencies) in students:

*Table 2.1. List of competencies formed by students during the development of the discipline (LEARNING OUTCOMES)*

Code	Competence	Indicators of competence achievement (within the framework of this discipline)
<b>ОПК-2.</b> <b>GPC -2</b>	Способен использовать специальные и новые разделы экологии, геоэкологии и природопользования при решении научно-исследовательских и прикладных задач профессиональной деятельности.  Able to use special and new sections of ecology, geoecology and nature management in solving research and applied tasks of professional activity	<b>ОПК-2.1</b> Знает основы экологии, геоэкологии, экономики природопользования и экономики замкнутого цикла, а также экологического менеджмента <b>GPC-2.1</b> Knows the basics of ecology, geoecology, environmental economics and closed-loop economics, as well as environmental management
<b>ОПК-3.</b> <b>GPC-3</b>	Способен применять экологические методы исследований для решения научно-исследовательских и прикладных задач профессиональной деятельности. Able to apply environmental research methods to solve research and applied tasks of professional activity	<b>ОПК-3.1</b> Знает принципы и методы экологического мониторинга компонентов окружающей среды <b>GPC-3.1</b> Knows the principles and methods of environmental monitoring of environmental components <b>ОПК-3.2</b> Владеет аналитическими методами контроля загрязняющих веществ и физических воздействий и обработки полученной информации <b>GPC-3.2</b> Owns analytical methods of control of pollutants and physical impacts and processing of the received information <b>ОПК-3.3</b> Умеет разрабатывать системы экологического мониторинга и контроля на производстве и решать прикладные задачи в профессиональной деятельности

Code	Competence	Indicators of competence achievement (within the framework of this discipline)
		<b>GPC-3.3</b> Is able to develop environmental monitoring and control systems at work and solve applied tasks in professional activity
<b>ПК-6</b> <b>СПС-6</b>	Способен диагностировать проблемы охраны природы, разрабатывать практические рекомендации по ее охране и обеспечению устойчивого развития Able to diagnose problems of nature protection, develop practical recommendations for its protection and sustainable development	<b>ПК-6.1</b> Способен выявлять несоответствия состояния компонентов окружающей среды требованиям национальных и международных стандартов <b>СПС-6.1</b> It is able to detect inconsistencies in the state of environmental components with the requirements of national and international standards <b>ПК-6.2</b> Способен разрабатывать программы мониторинга природных комплексов в условиях техногенных нагрузок и программы экологической реабилитации территорий <b>СПС-6.2</b> Is able to develop programs for monitoring natural complexes under conditions of man-made loads and programs for environmental rehabilitation of territories

### 3. COURSE IN HIGHER EDUCATION PROGRAMME STRUCTURE

The discipline “Monitoring of natural and man-made systems/ Мониторинг природно-техногенных систем” refers to Compulsory Disciplines of the Higher Education Program.

Within the framework of the higher education program, students also master other disciplines and/or practices that contribute to expected learning outcomes of the discipline “Monitoring of natural and man-made systems/ Мониторинг природно-техногенных систем”.

*Table 3.1. List of Higher Education Program components that contribute to expected learning outcomes*

Code	Competence	Previous Disciplines (Modules)	Subsequent Disciplines (Modules)
<b>ОПК-2.</b> <b>GPC -2</b>	Способен использовать специальные и новые разделы экологии, геоэкологии и природопользования при решении научно-исследовательских и прикладных задач профессиональной деятельности.		Современные проблемы экологии и природопользования / Modern problems of ecology and nature management HSE менеджмент / HSE-management Методы мониторинга экологической безопасности природопользования / Methods of monitoring environmental safety of nature management / Methods of monitoring environmental safety of

Code	Competence	Previous Disciplines (Modules)	Subsequent Disciplines (Modules)
	Able to use special and new sections of ecology, geocology and nature management in solving research and applied tasks of professional activity		nature management / Methods of monitoring environmental safety of nature management Мониторинг природно-техногенных систем / Monitoring of natural and man-made systems Дисциплины по выбору Б1.В.ДВ.2 Геохимические методы оценки окружающей среды / Geochemical methods of environmental assessment Ландшафтное планирование / Landscape planning Региональная геоэкологическая оценка территорий / Regional geocological assessment of territories Производственная практика / Production practice
<b>ОПК-3.</b> <b>GPC-3</b>	Способен применять экологические методы исследований для решения научно-исследовательских и прикладных задач профессиональной деятельности. Able to apply environmental research methods to solve research and applied tasks of professional activity		Методы мониторинга экологической безопасности природопользования / Methods of monitoring environmental safety of nature management / Methods of monitoring environmental safety of nature management / Methods of monitoring environmental safety of nature management
<b>ПК-6</b> <b>SPC-6</b>	Способен диагностировать проблемы охраны природы, разрабатывать практические рекомендации по ее охране и обеспечению устойчивого развития Able to diagnose problems of nature protection, develop practical recommendations for its protection and		Методы мониторинга экологической безопасности природопользования / Methods of monitoring environmental safety of nature management / Methods of monitoring environmental safety of nature management / Methods of monitoring environmental safety of nature management Производственная практика / Production practice Преддипломная практика

Code	Competence	Previous Disciplines (Modules)	Subsequent Disciplines (Modules)
	sustainable development		

#### 4. COURSE WORKLOAD AND ACADEMIC ACTIVITIES

Workload of the course “Monitoring of natural and man-made systems/ Мониторинг природно-техногенных систем” is 4 ECTS.

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

Вид учебной работы	TOTAL	Semesters			
		1	2	3	4
<i>Contact academic hours</i>	51	51			
Incl.:					
Lectures	17	17			
Lab work					
Seminars	34	34			
<i>Self-study</i>	66	66			
<i>Evaluation and assessment</i>	27	27			
<b>Total workload</b>	Ac.hours	<b>144</b>	<b>144</b>		
	ECTS	<b>4</b>	<b>4</b>		

#### 5. COURSE CONTENTS

Table 5.1. The content of the discipline (module) by type of academic work

Name of the discipline section	Content of the section (topics)	Type of academic activity*
Introduction.	State of natural systems and their stability. Description models. Environmental norms and assessment of the stability of natural systems. Monitoring of the environmental quality on the base of environmental indicators.	Lectures Seminars
PEM in the structure of the environmental monitoring system.	ESSM, departmental environmental monitoring of IEM in the structure of the environmental monitoring system. ESSM, departmental environmental monitoring. Legislative and regulatory-technical base of the organization of IEM .	Lectures Seminars
Instruments and systems for monitoring the atmosphere and air of the working area	Instruments and systems for monitoring the atmosphere and air of the working area. Regulatory support for monitoring. The main types of devices. Approaches to the organization of monitoring of the atmosphere in production	Lectures Seminars

	conditions. GIS technologies and remote methods. Use of IEM data of the state of the atmosphere	
Instruments and systems for monitoring the quality of water bodies.	Devices and systems for monitoring the quality of water bodies. Regulatory support for monitoring. Surface water monitoring system. Monitoring of groundwater. Geodynamic monitoring. GIS technologies and remote methods.	Lectures Seminars
Soil quality monitoring devices and systems	Soil quality monitoring devices and systems. Regulatory support for monitoring. Methods of selection and indicators of soil and soil quality. GIS technologies and remote methods.	Lectures Seminars
Devices and systems for monitoring the quality of biological resources	Devices and systems for monitoring the quality of biological resources. Regulatory support for monitoring. Monitoring of the state of biological objects. Bioindication. GIS technologies and remote methods.	Lectures Seminars

## 6. CLASSROOM EQUIPMENT AND TECHNOLOGY SUPPORT REQUIREMENTS

*Table 6.1. Classroom equipment and technology support requirements*

<b>Classroom for Academic Activity Type</b>	<b>CLASSROOM EQUIPMENT</b>	<b>Specialized learning, laboratory equipment, software and materials for the mastering the course</b>
Lecture	An auditorium for conducting lecture-type classes, equipped with a set of specialized furniture; a board (screen) and technical means of multimedia presentations.	-
Seminars	Classroom, equipped with a set of specialized furniture; whiteboard; 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	-
Self-studies	An auditorium for independent work of students (can be used for seminars and consultations), equipped with a set of specialized furniture and computers with access to an electronic information and	-

<b>Classroom for Academic Activity Type</b>	<b>CLASSROOM EQUIPMENT</b>	<b>Specialized learning, laboratory equipment, software and materials for the mastering the course</b>
	educational environment.	

## 7. RECOMMENDED SOURCES FOR COURSE STUDIES

- *Main reading:*

1. Environmental Monitoring Handbook for the Food and Beverage Industries, 2019. URL: <https://multimedia.3m.com/mws/media/1684575O/environmental-monitoring-handbook.pdf>

- *Additional sources:*

1. Wiersma G.B. (Ed.) Environmental Monitoring. CRC Press, 2004, 1566706416, 767 p.
2. Belyuchenko I.S., Smagin A.V. Fundamentals of Environmental Monitoring. KubGAU press. 2012.

- *Internet-sources:*

1. Electronic library system of the RUDN and third-party electronic library systems, to which university students have access on the basis of concluded contracts:
  - electronic library system of the RUDN University <http://lib.rudn.ru/MegaPro/Web>
  - electronic library system «Университетская библиотека онлайн» <http://www.biblioclub.ru>
  - electronic library system Юрайт <http://www.biblio-online.ru>
  - electronic library system «Консультант студента» [www.studentlibrary.ru](http://www.studentlibrary.ru)
  - electronic library system «Лань» <http://e.lanbook.com/>
  - electronic library system «Троицкий мост»
2. Databases and search engines:
  - electronic fund of legal and regulatory and technical documentation <http://docs.cntd.ru/>
  - Yandex search engine <https://www.yandex.ru/>
  - Google search engine <https://www.google.ru/>
  - abstract database SCOPUS <http://www.elsevierscience.ru/products/scopus/>
  - .....

*Educational and methodological materials for independent work of students during the development of the discipline/ module \*:*

1. A course of lectures on the discipline “Monitoring of natural and man-made systems/ Мониторинг природно-техногенных систем”.

\* - all educational and methodological materials for independent work of students are placed in accordance with the current procedure on the discipline page in the Telecommunication educational and Information System!

## 8. MID-TERM ASSESSMENT AND EVALUATION TOOLKIT

Evaluation materials and a point-rating system\* for assessing the level of competence formation (part of competencies) based on the results of mastering the discipline “Monitoring of natural and man-made systems/ Мониторинг природно-техногенных систем” are presented in the Appendix to this Work Program of the discipline.

\* - evaluation toolkit and ranking system are formed on the basis of the requirements of the relevant local regulatory act of the RUDN (regulations / order).

### DEVELOPER:

Professor of the Department of  
Environmental Safety and  
Product Quality Management

Position, Department



Signature

**Redina M.M.**

Name

### HEAD OF THE DEPARTMENT:

Head of the Department of  
Environmental Safety and  
Product Quality Management

Department



Signature

**Savenkova E.V.**

Name

### HAED OF THE HIGHER EDUCATION PROGRAM:

Professor of the Department of  
Environmental Safety and  
Product Quality Management

Position, Department



Signature

**Redina M.M.**

Name