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

Institute of Environmental Engineering
(наименование основного учебного подразделения (ОУП)-разработчика ОП ВО)

COURSE SYLLABUS

Информационные технологии в природопользовании / Information technologies in nature management
(наименование дисциплины/модуля)

Recommended by the Methodological Council for the Education Field:

05.04.06 Ecology and nature management
(код и наименование направления подготовки/специальности)

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

УПРАВЛЕНИЕ ПРИРОДОПОЛЬЗОВАНИЕМ / NATURE MANAGEMENT
(наименование (профиль/специализация) ОП ВО)

2022

1. COURSE GOALS

The purpose of the discipline is to get acquainted with modern information technologies in nature managementand applications in the environmental protection and management.

2. LEARNING OUTCOMES

The mastering of the discipline "Информационные технологии в природопользовании / Information technologies in nature management" 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) ПК-1.1; ПК-1.2; ПК-3.1; ПК-3.2; ПК-4.1; ПК-4.2; ПК-4.3;

Code	Competence	Indicators of competence achievement (within the framework of this discipline)
ОПК-2 GPC-2	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	**ОПК-2.3** Способен находить, анализировать и грамотно использовать новейшую информацию и современные методики при выполнении научно-исследовательских и прикладных задач **GPC-2.3** He is able to find, analyze and competently use the latest information and modern techniques when performing research and applied tasks
ОПК-3. GPC-3.	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	**ОПК-3.3** Умеет разрабатывать системы экологического мониторинга и контроля на производстве и решать прикладные задачи в профессиональной деятельности **GPC-3.3** Is able to develop environmental monitoring and control systems at work and solve applied tasks in professional activity
ОПК-5. GPC-5.	Способен решать задачи профессиональной деятельности в области экологии, природопользования и охраны природы с использованием информационно-	**ОПК-5.1** Умеет выбирать и применять алгоритм решения экологических задач и реализует алгоритмы с использованием программных средств **GPC-5.1** Knows how to choose and apply an algorithm for solving environmental problems and implements algorithms using software tools

	коммуникационных, в т. ч. геоинформационных технологий. Is able to solve the tasks of professional activity in the field of ecology, nature management and nature protection using information and communication, including geoinformation technologies	**ОПК-5.2** Владеет навыками применения средств информационных технологий для поиска, хранения, обработки, анализа и представления информации **GPC-5.2 Has the skills of using information technology tools to search, store, process, analyze and present information**
		ОПК-5.3 Умеет обрабатывать данные дистанционного зондирования Земли и использовать картографические материалы, владеет современными ГИС-технологиями **GPC-5.3** Is able to process Earth remote sensing data and use cartographic materials, owns modern GIS technologies
ПК-1 **SPC-1**	Способность формулировать проблемы, задачи и методы научного исследования, обобщать полученные результаты, формулировать выводы и практические рекомендации на основе результатов исследований The ability to formulate problems, tasks and methods of scientific research, summarize the results obtained, formulate conclusions and practical recommendations based on research results	**ПК-1.1** Знает основы методологии планирования исследований **SPC-1.1** Knows the basics of research planning methodology
		ПК-1.2 Умеет обобщать полученные результаты, формулировать выводы и практические рекомендации на основе результатов исследований **SPC-1.2** He is able to summarize the results obtained, formulate conclusions and practical recommendations based on the results of research
ПК-3 **SPC-3**	Владение основами проектирования, экспертно-аналитической деятельности и выполнения исследований с использованием современных подходов и методов, аппаратуры и вычислительных комплексов Knowledge of the basics of design, expert-analytical activity and research using modern approaches and methods, equipment and computer systems	**ПК-3.1** Способен планировать внедрение современных подходов и методов, аппаратуры и вычислительных комплексов для решения задач в профессиональной области **SPC-3.1** Is able to plan the implementation of modern approaches and methods, equipment and computer systems for solving problems in the professional field
		ПК-3.2 Владеет основами проектирования и экспертно-аналитической деятельности **SPC-3.2** Owns the basics of design and expert-analytical activity
ПК-4 **SPC-4**	Способен использовать современные методы обработки и интерпретации экологической информации при проведении научных и производственных исследований Is able to use modern methods of processing and interpretation of	**ПК-4.1** Умеет применять современные методы обработки и интерпретации экологической информации при проведении производственных исследований **SPC-4.1** Is able to apply modern methods of processing and interpretation of environmental information when conducting industrial research
		ПК-4.2 Способен интерпретировать полученные результаты исследований сточки зрения

	environmental information during scientific and industrial research	соблюдения показателей безопасности и эффективности деятельности **SPC-4.2** Is able to interpret the obtained research results from the point of view of compliance with safety and performance indicators
		ПК-4.3 Владеет навыками проведения контрольно-надзорных мероприятий на основе современных методов обработки экологической информации **SPC-4.3** Has the skills of conducting control and supervisory activities based on modern methods of processing environmental information

3. COURSE IN HIGHER EDUCATION PROGRAMME STRUCTURE

The discipline " Информационные технологии в природопользовании / Information technologies in nature management" 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 "Информационные технологии в природопользовании / Information technologies in nature management".

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

Code	**Competence**	Previous Disciplines (Modules)	Subsequent Disciplines (Modules)
ОПК-2 **GPC-2**	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	Современные проблемы экологии и природопользования / Modern probems of ecology and nature manegement HSE менеджмент / HSE-management Методы мониторинга экологической безопасности природопользования / Methods of monitoring environmental safety of nature management Мониторинг природно-техногенных систем / Monitoring of natural and man-made systems	Ландшафтное планирование / Landscape planning Производственная практика / Production practice
ОПК-3. **GPC-3.**	Способен применять экологические методы исследований для решения научно-	Методы мониторинга экологической безопасности природопользования /	

Code	Competence	Previous Disciplines (Modules)	Subsequent Disciplines (Modules)
	исследовательских и прикладных задач профессиональной деятельности. Able to apply environmental research methods to solve research and applied tasks of professional activity	Methods of monitoring environmental safety of nature management Мониторинг природно-техногенных систем / Monitoring of natural and man-made systems	
ОПК-5. **GPC-5.**	Способен решать задачи профессиональной деятельности в области экологии, природопользования и охраны природы с использованием информационно-коммуникационных, в т. ч. геоинформационных технологий. Is able to solve the tasks of professional activity in the field of ecology, nature management and nature protection using information and communication, including geoinformation technologies		Производственная практика / Production practice
ПК-1 **SPC-1**	Способность формулировать проблемы, задачи и методы научного исследования, обобщать полученные результаты, формулировать выводы и практические рекомендации на основе результатов исследований The ability to formulate problems, tasks and methods of scientific research, summarize the results obtained, formulate conclusions	Методология научного творчества / Methodology of scientific creativity HSE менеджмент / HSE-management Экологическое проектирование промышленных объектов / Environmental design of industrial facilities Современные методы и технологии защиты окружающей среды / Modern methods and technologies of environmental protection	Научно-исследовательская работа в семестре, включая курсовые работы / Research work in the semester, including term papers Производственная практика / Production practice

Code	Competence	Previous Disciplines (Modules)	Subsequent Disciplines (Modules)
	and practical recommendations based on research results	Комплексная оценка природных и производственных потенциалов территорий / Comprehensive assessment of natural and industrial potentials of territories	
ПК-3 SPC-3	Владение основами проектирования, экспертно-аналитической деятельности и выполнения исследований с использованием современных подходов и методов, аппаратуры и вычислительных комплексов Knowledge of the basics of design, expert-analytical activity and research using modern approaches and methods, equipment and computer systems	Экологическое проектирование промышленных объектов / Environmental design of industrial facilities Хранение, переработка и утилизация отходов / Storage, processing and disposal of waste	Международные стандарты управления качеством окружающей среды / International Environmental Quality Management Standards Управление минерально-сырьевым комплексом / Management of the mineral resource complex Научно-исследовательская работа в семестре, включая курсовые работы / Research work in the semester, including term papers Производственная практика / Production practice Преддипломная практика
ПК-4 SPC-4	Способен использовать современные методы обработки и интерпретации экологической информации при проведении научных и производственных исследований Is able to use modern methods of processing and interpretation of environmental information during scientific and industrial research	Компьютерные технологии и статистические методы в экологии и природопользовании / IT in ecology and nature management	Международные стандарты управления качеством окружающей среды / International Environmental Quality Management Standards Управление минерально-сырьевым комплексом / Management of the mineral resource complex Научно-исследовательская работа в семестре, включая курсовые работы / Research work in the semester, including term papers

Code	Competence	Previous Disciplines (Modules)	Subsequent Disciplines (Modules)
			Производственная практика / Production practice

4. COURSE WORKLOAD AND ACADEMIC ACTIVITIES

Workload of the course « Информационные технологии в природопользовании / Information technologies in nature management» 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
Contact academic hours		*34*		*34*		
Incl.:						
Lectures						
Lab work						
Seminars		34		34		
Self-study		*83*		*83*		
Evaluation and assessment		*27*		*27*		
Total workload	Ac.hours	**144**		**144**		
	ECTS	**4**		**4**		

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. General ideas about remote methods in environmental research.	The essence, possibilities and limitations of remote control methods. The concept of geoinformation technologies and GIS systems. Purpose and concepts of GIS. GIS architecture. Databases.	Seminars
GIS cartographic projections.	Elements of an Earth ellipsoid. Basic coordinate systems. The relationship between the coordinates on the ellipsoid and the plane. The Gauss-Kruger projection, as a basic projection of cartographic constructions. Transverse Mercator projection and Lambert spherical projection. The need to use different projections in solving environmental problems. Mutual transformations of projections Transform transformations of coordinates.	Seminars
Mathematical processing of environmental data in Excel.	Function operators. Maps of isolines of feature distribution in space and methods of their construction: Spatial (three-dimensional) models of relief and geological bodies. Combining three-dimensional relief images and maps of pollutants.	Seminars

Electronic cards and . ways to create them.	Raster and vector formats of electronic images. Transfer of images from paper media to electronic form. Exporting bitmaps to GIS.	Seminars
Organizational aspects and technical support of remote methods	Organizational aspects of the application and technical support of remote methods. Remote methods in solving state and local problems. Instrumental support	Seminars
Control task.	Vector maps and methods from creation. The formats of vector maps in GIS are specialized GIS - a means of analyzing the ecological situation, solving the ecological and geochemical problem of assessing technogenic pollution of the territory. Combining three-dimensional relief images and maps of pollutants.	Seminars

6. CLASSROOM EQUIPMENT AND TECHNOLOGY SUPPORT REQUIREMENTS

Table 6.1. Classroom equipment and technology support requirements

Classroom for Academic Activity Type	**CLASSROOM EQUIPMENT**	**Specialized learning, laboratory equipment, software and materials for the mastering the course**
Lecture	-	-
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 educational environment.	-

7. RECOMMENDED SOURCES FOR COURSE STUDIES

Main reading:

1. Sahdev S., Singh R. B., Kumar M. (ed.). Geoecology of Landscape Dynamics. – Springer, 2020. URL: https://link.springer.com/content/pdf/10.1007/978-981-15-2097-6.pdf

Additional sources:

1. Nakashima S. et al. Geochemistry and the origin of life: From extraterrestrial processes, chemical evolution on earth, fossilized life's records, to natures of the extant life //Life. – 2018. – Т. 8. – №. 4. – С. 39.

2. Deutsch W. J. Groundwater geochemistry: fundamentals and applications to contamination. – CRC press, 2020. URL:

https://www.taylorfrancis.com/books/mono/10.1201/9781003069942/groundwater-geochemistry-william-deutsch

3. Pourret O. et al. Open Access publishing practice in geochemistry: overview of current state and look to the future //Heliyon. – 2020. – Т. 6. – №. 3. – С. e03551.

4. Zaburaeva K. S., Daukaev A. A. Strategy of Forming the Geoecological Framework of the Territory: on the Example of the Chechen Republic //International Symposium" Engineering and Earth Sciences: Applied and Fundamental Research" dedicated to the 85th anniversary of HI Ibragimov (ISEES 2019). – Atlantis Press, 2019. – С. 685-691.

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
- 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 "Информационные технологии в природопользовании / Information technologies in nature management".

* - 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 "Информационные технологии в природопользовании / Information technologies in nature management" 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 ERNM Department		**Stanis E.V.**

Position, Department	Signature	Name
HEAD OF THE DEPARTMENT: Head of the Department of Environmental Safety and Product Quality Management		**Savenkova E.V.**
Department	Signature	Name
HAED OF THE HIGHER EDUCATION PROGRAM: Professor of the Department of Environmental Safety and Product Quality Management		**Redina M.M.**
Position, Department	Signature	Name