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

Компьютерные технологии и статистические методы в экологии и природопользовании / IT in ecology and 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 course goal is to develop students' understanding of the role, significance and limitations of the use of statistical methods in scientific and practical socio-economic and environmental research; to teach how to use methods for assessing the representativeness of the material, the volume of samples when conducting quantitative studies, statistical methods for comparing the data obtained and determining patterns; to form the skill of using modern computer tools for processing statistical data and in solving problems of future professional and scientific activities.

2. LEARNING OUTCOMES

The mastering of the discipline "Компьютерные технологии и статистические методы в экологии и природопользовании / IT in ecology and 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-4.1; ПК-4.2; ПК-4.3; УК-7.3

Code	Competence	Indicators of competence achievement (within the framework of this discipline)
УК-7. **GC-7**.	Способен к использованию цифровых технологий и методов поиска, обработки, анализа, хранения и представления информации (в области Экологии и природопользования) в условиях цифровой экономики и современной корпоративной информационной культуры. Able to use digital technologies and methods of searching, processing, analyzing, storing and presenting information (in the field of Ecology and nature management) in the digital economy and modern corporate information culture	**УК-7.1** владеет навыками использования цифровых технологий и методов поиска, **GC-7.1** has the skills to use digital technologies and search methods
		УК-7.2 умеет обрабатывать, анализировать, хранить и правильно представлять информацию **GC-7.2** is able to process, analyze, store and correctly present information
		УК-7.3 знает принципы и приемы современной корпоративной информационной культуры и основы цифровой экономики **GC-7.3** knows the principles and techniques of modern corporate information culture and the basics of the digital economy
ОПК-5 GPC-5	**ОПК-5.** Способен решать задачи профессиональной деятельности в области экологии, природопользования и охраны природы с использованием информационно-коммуникационных, в т. ч. геоинформационных технологий.	**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

Code	Competence	Indicators of competence achievement (within the framework of this discipline)
	GPC-5. 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	
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	**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 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 контроль-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 "***Компьютерные технологии и статистические методы в экологии и природопользовании / IT in ecology and 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 " Компьютерные технологии и статистические методы в экологии и природопользовании / IT in ecology and 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)
УК-7 **GC-7**	**УК-7**. Способен к использованию цифровых технологий и методов		Научно-исследовательская работа в семестре, включая курсовые работы

Code	Competence	Previous Disciplines (Modules)	Subsequent Disciplines (Modules)
	поиска, обработки, анализа, хранения и представления информации (в области Экологии и природопользования) в условиях цифровой экономики и современной корпоративной информационной культуры. **GC-7** Able to use digital technologies and methods of searching, processing, analyzing, storing and presenting information (in the field of Ecology and nature management) in the digital economy and modern corporate information culture		/ Research work in the semester, including term papers Производственная практика / Production practice
ОПК-5 **GPC-5**	**ОПК-5.** Способен решать задачи профессиональной деятельности в области экологии, природопользования и охраны природы с использованием информационно-коммуникационных, в т. ч. геоинформационных технологий. **GPC-5.** 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		Информационные технологии в природопользовании / Information technologies in nature management Производственная практика / Production practice
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		Информационные технологии в природопользовании / Information technologies in nature management Дисциплины по выбору Б1.В.ДВ.4 Международные стандарты управления качеством окружающей среды / International Environmental Quality Management Standards Управление минерально-сырьевым комплексом / Management of the mineral resource complex

Code	Competence	Previous Disciplines (Modules)	Subsequent Disciplines (Modules)
	during scientific and industrial research		Научно-исследовательская работа в семестре, включая курсовые работы / Research work in the semester, including term papers Производственная практика / Production practice

4. COURSE WORKLOAD AND ACADEMIC ACTIVITIES

Workload of the course « Компьютерные технологии и статистические методы в экологии и природопользовании / IT in ecology and nature management» is 3 ECTS.

Table 4.1. Types of academic activities during the period of the HE program mastering ***ОЧНОЙ*** *формы обучения*

Вид учебной работы		**TOTAL**	**Semesters**			
			1	**2**	**3**	**4**
Contact academic hours		*51*	*51*			
Incl.:						
Lectures		17	17			
Lab work						
Seminars		34	34			
Self-study		*57*	*57*			
Evaluation and assessment		*0*	*0*			
Total workload	Ac.hours	**108**	**108**			
	ECTS	**3**	**3**			

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. Application of computer technologies in the work of an ecologist	Computational methods for assessing environmental impact, risk assessment, etc. Application of computer tools (Excel) for economic and environmental calculations. Specialized programs for complex calculations for environmental impact assessment, risk analysis. Graphics processing software	Lectures, Seminars
Primary processing of statistical data in Excel	Distribution characteristics, their interpretation and methods of finding them in a given sample. Compilation of interval series and determination of characteristics for a series. Visualization of statistical data	Lectures, Seminars

Assessment of the characteristics of the general population. Observation errors	Observation errors and confidence intervals for characteristics of large and small samples. Determination of the required sample size	Lectures, Seminars
Testing statistical hypotheses	Statistical hypotheses and their application to solving real problems. Parametric criteria and conditions for their application. Testing the hypothesis about the distribution law. Comparison of two samples by mean value and comparison of variances of two samples using parametric tests. Nonparametric tests. Computing consistent ranks. Comparison of two samples by the mean and comparison of variances of two samples using nonparametric tests. Data consistency assessment.	Lectures, Seminars
ANOVA	Comparison of averages in more than two objects. Analysis of variance. Nonparametric ANOVA	Lectures, Seminars
Correlation-regression analysis	Statistical connection and methods of its study. Correlation coefficient: graphical assessment, Pearson, Spearman, Kendall coefficients. Linear regression analysis. Pairwise linear regression. Multiple Linear Regression. Non-linear regression models. Correlation ratio	Lectures, Seminars
Time series analysis	Dynamic (time) series, their classification, structure, tasks and conditions of study. Indicators of the analysis of the series of dynamics. Time series trend analysis. Making forecasts. Revealing seasonal irregularities in time series	Lectures, 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	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	-

Classroom for Academic Activity Type	CLASSROOM EQUIPMENT	Specialized learning, laboratory equipment, software and materials for the mastering the course
	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. Ott W. R. Environmental statistics and data analysis. – Routledge, 2018.

Additional sources:

1. Ledashcheva T.N., Bragina L.V., Chemodanova V.I. Lecture notes for the course "Statistical analysis of ecosystems" Moscow, 2011 - available at the department and in electronic form
2. Ledashcheva T.N., Chemodanova V.I. Analysis of statistical data: workshop. Moscow, 2016 - available at the department and in electronic form
3. Statistical collection "Regions of Russia 2007" - available in electronic form
4. Gmurman V.E. Probability theory and mathematical statistics: Textbook for universities – M. : High School, 2003
5. Gorbatsevich V.V. Time series analysis and forecasting. Methodological instructions for lecturing and conducting practical exercises. M., 2000.

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 "Компьютерные технологии и статистические методы в экологии и природопользовании / IT in ecology and 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 of mastering the discipline " Компьютерные технологии и статистические методы в экологии и природопользовании / IT in ecology and 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).

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