PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA NAMED AFTER PATRICE LUMUMBA

Institute of Environmental Engineering

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

COURSE SYLLABUS

Engineering Ecology / Инженерная экология

(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:

«Integrated Solid Waste Management»

(наименование (профиль/специализация) ОП ВО)

2025

1. COURSE GOALS

The course goal is to familiarization with theoretical basics and practical approachs of the impact of main industrial branches on the environmental systems as well as pollution prevention technologies.

2. LEARNING OUTCOMES

The mastering of the discipline "Engineering ecology" 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)
PC-10	Capable of monitoring the state of the environment using environmental technologies	**PC-10.1** Capable of monitoring compliance with environmental protection requirements
		PC-10.2 Capable of developing an action plan aimed at meeting the requirements of regulatory legal acts in the field of environmental protection, taking into account best practices
		PC-10.3 Capable of analyzing large amounts of professional information
PC-11	Able to determine the structure and master the methods of zoning the assessed territory according to the types of anthropogenic load and environmental components	**PC-11.1** Knows methods of zoning the assessed territory according to the permissible anthropogenic load on environmental components
		PC-11.2 Able to determine the structure of anthropogenic load on environmental components
		PC-11.3 Able to identify areas of increased environmental hazard

3. COURSE IN HIGHER EDUCATION PROGRAMME STRUCTURE

The discipline "Engineering ecology" 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 "Engineering ecology".

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

Code	Competence	Previous Disciplines (Modules)	Subsequent Disciplines (Modules)
PC-10	Capable of monitoring the state of the environment using environmental technologies	ОВОС объектов в сфере управления отходами /Environmental impact assessment (EIA) of SWM objects	Master's Thesis Defence / State Exam /

Code	Competence	Previous Disciplines (Modules)	Subsequent Disciplines (Modules)
PC-11	Able to determine the structure and master the methods of zoning the assessed territory according to the types of anthropogenic load and environmental components	no	Master's Thesis Defence State Exam

4. COURSE WORKLOAD AND ACADEMIC ACTIVITIES

Workload of the course «Engineering ecology» is 3 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		17			17	
Lab work						
Seminars		17			17	
Self-study		*47*			*47*	
Evaluation and assessment		*27*			*27*	
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***
Anthropogenic processes as a factor of environmental pollution.	Modern anthropogenic activities and environmental pollution factors. OS components: atmosphere, hydrosphere, pedosphere. Features of the distribution of ecotoxicants in abiotic and biotic components.	L, S
Self-cleaning ability of ecosystems. Ecosystem sustainability parameters	Principles of the existence of ecosystems. Homeostasis. Resistance of ecosystems to pollution. Cycle of substances and elements. Soil microbiocenosis and soil functions.	L, S
	The ability of ecosystems to self-purification. Abiotic processes of self-purification. Biotic processes of self-purification.	L, S
	Microbiocenoses of water bodies. Air microflora. Degree and speed of self-	L, S

	cleaning. Assimilative capacity of the ecosystem	
Sources and types of hydrosphere pollution. Wastewater	Main sources of wastewater generation. Classification and composition of wastewater. Types of wastewater pollution.	L, S
	Modern methods of wastewater treatment. Technological cleaning schemes. Organization of closed water production cycles.	L, S
Sources and types of atmospheric pollution. Gas-air emissions.	Sources and types of air pollution. Classification and composition of gas-air emissions.	L, S
	Principles of atmospheric air protection. Modern methods of cleaning gas-air emissions and protecting atmospheric air.	L, S
Sources and types of pedosphere pollution. Solid waste	Sources and types of pedosphere pollution. Solid waste concept. Sources of generation and classification of waste. Hazardous waste	L, S
	Fundamentals of sustainable waste management. Energy and material potential of waste. Principles of the circular economy.	L, S
	Sources of formation of solid industrial waste. Municipal solid waste. Environmental features of hazardous waste.	L, S
Modern methods of solid waste and sewage sludge handling	Basic methods of industrial non-radioactive waste liquidation and processing. Disposal in landfills and dumpsites. Heat treatment.	L, S
	Basic methods of processing and disposal of municipal solid waste. Sorting and use as secondary raw materials.	L, S
Accumulated environmental damage (AED). AED objects and their remediation (restoration)	Classification of NVOS objects. Stages and methods of environmental rehabilitation of environmental waste facilities: technical, biological.	L, S
	Remediation of soils and closed landfills. Soils and grounds treatment from ecotoxicants (petroleum products, heavy metals). Biological methods for restoring reservoirs. Purification of water bodies from oil products and heavy metals	L, S

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	A set of specialized furniture; chalk board;

Classroom for Academic Activity Type	CLASSROOM EQUIPMENT	Specialized learning, laboratory equipment, software and materials for the mastering the course
	furniture; a board (screen) and technical means of multimedia presentations.	technical equipment: HP PRO system unit, HP-V2072A monitor, LUMIEN retractable projection screen, Internet access. Microsoft Windows 7 corporate. License No. 5190227, date of issue 03/16/2010 MS Office 2007 Prof, License No. 6842818, issue date 09/07/2009
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. Saxena, Gaurav, R. Kishor, and R. N. Bharagava. Bioremediation of industrial waste for environmental safety. Springer Singapore, 2020..
2. Foo D. C. Y., Gopakumar S. T., Show P. L. Green Technologies: Bridging Conventional Practices and Industry 4.0. – MDPI-Multidisciplinary Digital Publishing Institute, 2020.
3. Coelho S. T. et al. (ed.). Municipal Solid Waste Energy Conversion in Developing Countries: Technologies, Best Practices, Challenges and Policy. – Elsevier, 2019.
4. Kumar S., Kalamdhad A., Ghangrekar M. M. (ed.). Sustainability in Environmental Engineering and Science: Select Proceedings of SEES 2019. – Springer, 2020.
5. Cairncross S., Feachem R. Environmental health engineering in the tropics: Water, sanitation and disease control. – Routledge, 2018.

Additional sources:

1. Mihelcic J. R., Zimmerman J. B. Environmental engineering: Fundamentals, sustainability, design. – John wiley & sons, 2021.
2. Jain S. K., Singh V. P. Engineering hydrology: an introduction to processes, analysis, and modeling. – McGraw-Hill Education, 2019.
3. Salem M. A. et al. Environmental technology and a multiple approach of competitiveness //Future Business Journal. – 2020. – Т. 6. – №. 1. – С. 1-14.
4. Wang L. K. et al. (ed.). Integrated natural resources management. – Switzerland : Springer Nature, 2021. – Т. 20.

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 "Engineering ecology".

* - 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 "Engineering ecology" 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:

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Position, Department	Signature	Name

HEAD OF THE DEPARTMENT:

ESandPQM Department		**Savenkova E.V.**
Department	Signature	Name

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