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**Federal State Autonomous Educational Institution for Higher Education
PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA NAMED AFTER PATRICE LUMUMBA
(RUDN University)**

Institute of Environmental Engineering

COURSE SYLLABUS

**Software Tools for Waste Management / Программное обеспечение для
управления отходами**

**Recommended by the Didactic Council for the Education Field for the specialization:
05.04.06 "Ecology and Nature Management"**

**The mastering of the course is carried out as part of the implementation of the main
professional syllabus (Higher Education programme, specialization)**

**Integrated Solid Waste Management / Комплексное управление твердыми бытовыми
отходами**

1. COURSE GOAL(s)

The course is designed to is aimed at studying specialized software for performing calculations and analyzing results in the solid waste management system and in solving theoretical and practical problems, including in the field of industrial and consumer waste management, management of solid waste landfills and assessment of their impact on the environment.

• 2. REQUIREMENTS FOR COURSE OUTCOMES

The process of studying the discipline is aimed at the formation of the following competencies:

Code	Code and name of the graduate's competence	Code and name of the indicator of achievement of competence
GC-6	Able to identify and implement the priorities of their own activities and ways to improve it based on self-assessment	GC-6.1 can evaluate resources and their limits (personal, situational, temporary), use them appropriately
		GC-6.2 capable to determine educational needs and ways to improve their own (including professional) activities based on self-assessment
		GC-6.3 owns skills in the flexible professional trajectory building, taking into account the accumulated experience of professional activity, dynamically changing labor market requirements and personal development strategies
GC-7	Able to use basic knowledge in the field of information culture	GC-7.1 Applies statistical methods in scientific and practical research; computer tools for data processing and problem solving
		GC-7.2 Formulates the problem of processing real data in terms of a real problem
GPC-5	Able to solve professional problems in the field of ecology, environmental management and nature conservation using information and communication technologies, including geoinformation technologies	GPC-5.1 Knows the theoretical, methodological and practical foundations of the use of information technologies in environmental assessment
		GPC-5.2 Proficient in modern methods of assessing environmental information to solve theoretical and practical problems of assessing the environmental safety of natural resources management
		GPC-5.3 is able to select and apply an algorithm for solving environmental problems and implements algorithms using software
PC-4	ability to use modern methods of processing and interpreting environmental information when conducting scientific and industrial research	PC-4.2 Know computer tools for processing statistical data and solving statistical problems
		PC-4.3 Be able to formulate the problem of processing real data in terms of mathematical statistics, choose methods for processing statistical data to solve real problems
PC-12	Able to use modern means of geographic information systems and information and communication technologies in professional activities	PC-12.1 Able to use modern information technologies and specialized programs for processing the received data and conducting their analysis

3. COURSE IN HIGHER EDUCATION PROGRAMME STRUCTURE

Discipline *Methodology of Scientific Creation* refers to the **University Disciplines Module** block 1 of the curriculum.

Within the higher education programme students also master other disciplines (modules) and / or internships that contribute to the achievement of the expected learning outcomes as results of the course.

Table 3.1

The list of the higher education programme components that contribute to the achievement of the expected learning outcomes

Competence code	Competence descriptor	Previous courses/modules, internships*	Subsequent courses/modules, internships*
GC-6	Able to identify and implement the priorities of their own activities and ways to improve it based on self-assessment	no	Nature Protection and Accumulated Environmental Damage (AED) Elimination Tools
GC-7	Able to use basic knowledge in the field of information culture	no	Management of Environmental-economic Risks Environmental Control and MSW Monitoring Programs Physicochemical Methods of Waste Testing
GPC-5	Able to solve professional problems in the field of ecology, environmental management and nature conservation using information and communication technologies, including geoinformation technologies	no	Regional & Municipal MSW Management Systems /
PC-4	ability to use modern methods of processing and interpreting environmental information when conducting scientific and industrial research	no	Research Work / Preparing and Passing the State Exam /
PC-12	Able to use modern means of geographic information systems and information and communication technologies in professional activities	no	Research Work / Preparing and Passing the State Exam /

4. COURSE WORKLOAD AND ACADEMIC ACTIVITIES

The total workload of the discipline is 4 credit units.

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

Types of academic activities	Total hours	Semester(s)			
		1	2	3	4
<i>Contact academic hours</i>					
Lectures	17	17			

Types of academic activities	Total hours	Semester(s)			
		1	2	3	4
Lab works					
Seminars (workshops/tutorials)	17	17			
<i>Self-study</i>	50	50			
<i>Evaluation and assessment (exam; pass/fail grading)</i>	24	24			
The total course workload	ак.ч.	108	108		
	зач.ед.	3	3		

5. COURSE CONTENT

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

Title of Course Modules	Content	Types of academic activities
Module 1. Processing and presentation of measurement results	Excel	L, S
	Cluster analysis	L, S
Module 2. Environmental assessment	Tools for calculating dispersion, NDV (MPV), NMU, inventory (Integral)	L, S
	Greenhouse Gas Analysis Tools IPCC Waste Model, Landgem	L, S
Module 3. Modeling	Mathematical models (Vensim)	L, S
	Lcycle assessment	L, S
	Energy efficient houses	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 educational / laboratory equipment, software and materials for mastering the course (if necessary)
Lecture	Classroom, equipped with a set of specialized furniture; whiteboard; a set of devices includes portable multimedia projector, laptop, projection screen, stable wireless	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. Microsoft Windows 7 corporate. License No. 5190227, date of issue March 16, 2010
Seminars	Classroom, equipped with a set of specialized furniture; whiteboard; a set of devices includes portable multimedia projector, laptop, projection screen, stable wireless	

Classroom for Academic Activity Type	Classroom equipment	Specialized educational / laboratory equipment, software and materials for mastering the course (if necessary)
		MS Office 2007 Prof, License # 6842818, date of issue 09/07/2009
For Self-Study	Classroom for self-study (can be used for seminars and consultations), equipped with a set of devices includes laptop, stable wireless.	No

7. RECOMMENDED SOURCES FOR COURSE STUDIES

a) software

1. Excel
2. Integral
3. IPCC Waste Model, Landgem
4. Vensim
5. Life cycle assessment software (GABI)
6. Energy3d
7. QGIS

Main reading:

technical documentation for the above software

Internet-based sources

1. ELS of RUDN University and third-party ELS, to which university students have access on the basis of concluded agreements:

- RUDN Electronic Library System - RUDN EBS <http://lib.rudn.ru/MegaPro/Web>
- ELS "University Library Online" <http://www.biblioclub.ru>
- EBS Yurayt <http://www.biblio-online.ru>
- ELS "Student Consultant" www.studentlibrary.ru
- EBS "Lan" <http://e.lanbook.com/>
- EBS "Trinity Bridge"

2. Databases and search engines:

- electronic fund of legal and normative-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/>

8. MID-TERM ASSESSMENT AND EVALUATION TOOLKIT

The assessment toolkit and the grading system to evaluate the level of competences (competences in part) formation as results of mastering the discipline are specified in the Appendix to the syllabus.

DEVELOPER:

Associate Professor of the EM
Department

Position

Kapralova D.O.

Signature

Name, Surname

HEAD OF DEPARTMENT:

Director of EM Department

Position

Signature

Kucher D.E.

Name, Surname

HEAD OF PROGRAMME:

Associate Professor of the EM
Department

Position

Signature

Kapralova D.O.

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Institute of Environmental Engineering

ASSESSMENT TOOLKIT

**Software Tools for Waste Management / Программное обеспечение для
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**Recommended by the Didactic Council for the Education Field for the specialization:
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«Integrated Solid Waste Management / Комплексное управление твердыми отходами»

Passport to Assessment Toolkit for Course Software Tools for Waste Management / Программное обеспечение для управления отходами

Field of Studies / Speciality 05.04.06 "Ecology and nature management"/ «Climate Project Management»

Course: Software Tools for Waste Management / Программное обеспечение для управления отходами

Competences (competences in part) under assessment	Course module under assessment	Course topic under assessment	Tools to assess higher education programme mastering level						Points for topic	Points for module	
			Class work			Self-studies		Exam/Pass-fail assessment			
			Quiz	Test	Report	Practical task	Homework		Article		
			1	2		1	5		2	11	11
GC-6 GC-7 GPC-5 PC-4 PC-12	Module 1. Processing and presentation of measurement results	Excel		5		10					
		Cluster analysis				10					
GC-6 GC-7 GPC-5 PC-4 PC-12	Module 2. Environmental assessment	Tools for calculating dispersion, NDV (MPV), NMU, inventory (Integral)		5		10					
		Greenhouse Gas Analysis Tools IPCC Waste Model, Landgem				10					
GC-6 GC-7 GPC-5 PC-4 PC-12	Module 3. Modeling	Mathematical models (Vensim)		5		10					
		Life cycle assessment				10					
		Energy efficient houses				10					
		Total		15		70			15		100

Course Methodology of Scientific Creation

QUESTION CARD No 1

QUESTION 1. Explain the concept of “pivot table”. Describe the possibilities

QUESTION 2. on the basis of what regulations are surveys made in LandGEM?

3 *

Developer _____ (Kapralova Daria)
signature

Head of Educational Department _____ (Kutcher Dmitry)
signature

day, month, year

Note * Practice case/task inclusion is subject to the teacher’s discretion.

The set of exam question cards is complemented by the assessment criteria developed by the teacher and approved at the department meeting.

Assessment criteria:

(in compliance with the legal regulations in force)

EXAM QUESTIONS

- 1) what is a pivot table? What can it be used for?
- 2) describe the application of cluster analysis in environmental research. In what software can it be produced? What types of visualization of cluster analysis results are there?
- 3) what modules does INTEGRAL on the basis of what regulations are surveys made in LandGEM? consist of?
- 4) what methods underlie calculations in the INTEGRAL system?
- 5) what 2 calculation options exist in LandGEM?
- 6)
- 7) what gas emissions are calculated using the IPCC WASTE MODEL?
- 8) what process models can be created in Vensim software?
- 9) what options for output information exist in Vensim?
- 10) what types of software exist for life cycle assessment?
- 11) what types of calculations can be performed using Energy3D?

Tentative list of assessment tools

No	Assessment tool	Brief features	Assessment tool representation in the kit
<i>Class work</i>			
1	Survey/Quiz	A tool of control, organised as a special conversation between a teacher and students on topics related to the course under study, and designed to clarify the amount of students' knowledge in a particular section, topic, problem, etc.	Questions on the course topics /modules
2	Test	A system of standardised tasks that allows the teacher to automate the procedure for measuring the student's level of knowledge and skills	Tests bank
3	Control work	A tool of control organised as a classroom lesson, at which students need to independently demonstrate the acquisition and mastering of the educational material of the course topic, section, or sections.	Questions on the course topics /modules
4	Round table, discussion, polemic, dispute, debate, (class work)	Evaluation tools that allow the teacher to engage students in the process of discussing controversial issues, problems and assess their ability to argue their own point of view.	List of themes for round tables, discussions, polemics, disputes, debates.
5	Business game and/or role play	Joint activities of a student group under the teacher's control to solve educational and professionally oriented tasks through the simulation of a real-world problem; this activity allows the teacher to assess the students' ability to analyse and solve typical professional challenges.	Topic (problem), concept, roles and expected results for each game
6.	Presentation (defence) of project/report/ Library research paper /briefs *	A tool for monitoring the students' ability to present the work results to the audience.	Themes for projects/reports/ Library research paper/ briefs
7	Pass/Fail assessment	A tool for checking the quality of students' performance of laboratory work, acquisition and mastering of the practice training and seminar educational material, successful completion of the advanced field internship and pre-graduate internship and fulfillment of all training assignments in the course of these internships in accordance with the approved programme.	Tasks examples
8	Exam	The evaluation of the student's work during the semester (year, the entire period of study, etc.); it is designed to identify the level,	Examples of tasks/questions/exam question cards

		soundness and systematic nature of theoretical and practical knowledge gained by the student, formation of independent work skills, development of creative thinking, ability to synthesise the acquired knowledge and apply it to solve practice tasks.	
9	Case	A problem-solving task in which the student is asked to comprehend the real work-related (occupational) situation necessary to solve the problem.	Assignments to solve the case
10	Multi-level tasks and assignments with varying difficulty	The tasks and assignments differ in terms of the following levels: a) reproductive level allows the teacher to evaluate and diagnose the students' knowledge of factual material (basic concepts, algorithms, facts) and the students' ability to correctly use special terms and concepts, recognize objects of study within a certain section of the discipline, b) reconstructive level allows the teacher to evaluate and diagnose the students' abilities to synthesise, analyse, generalise factual and theoretical material and formulate specific conclusions, establish cause-and-effect relationships, c) creative level allows to evaluate and diagnose students' skills to integrate knowledge of various fields, argue their own point of view.	Set of multi-level tasks and assignments with varying difficulty
<i>Self- studies</i>			
1	Calculation and graphic work	A tool for checking students' skills in applying the acquired knowledge according to a predetermined methodology in task solving or fulfilling assignments for a module or discipline as a whole.	Set of tasks for calculation and graphic work
2	Course work/project	A type of independent written work aimed at the creative development of general professional and specialised professional disciplines (modules) and the development of relevant professional competences	Course assignment themes
3	Project	The final "product" that results from planning and performance of educational and research tasks set; it allows the teacher to assess the students' ability to independently shape their knowledge in the course of solving practice tasks and problems, navigate in the information environment and the students' level of analytical, research skills, skills of practical and creative thinking; it can be implemented individually or by a group of students.	Themes for team-based or individual projects

4	Reports, briefs	The product of the student's independent work, which is a public performance on the presentation of the results of solving a specific educational, practical, research or scientific topic.	Themes for reports, briefs
5	Standard calculations	A tool to test skills in applying the acquired knowledge, according to a predetermined methodology, solving tasks or fulfilling assignments for a module or discipline as a whole.	Set of tasks for standard calculations
6	Homework	The tasks and assignments differ in terms of the following levels: a) reproductive level allows the teacher to evaluate and diagnose the students' knowledge of factual material (basic concepts, algorithms, facts) and the students' ability to correctly use special terms and concepts, recognize objects of study within a certain section of the discipline, b) reconstructive level allows the teacher to evaluate and diagnose the students' abilities to synthesise, analyse, generalise factual and theoretical material and formulate specific conclusions, establish cause-and-effect relationships, c) creative level allows the teacher to evaluate and diagnose students' skills to integrate knowledge of various fields, argue their own point of view.	Set of multi-level tasks and assignments with varying difficulty

Example of practical task:

Jason makes diamond bracelets, necklaces and earrings.

He is going to work at a maximum of 160 hours a month.

He has 800 diamond ounces.

The table indicates profit, working time in hours and the number of diamonds in ounces for each product.

How can Jason maximize his profit with an unlimited need for each product?

Use the decision supporting system

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Position

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