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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**

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## **COURSE SYLLABUS**

### **Environmental Engineering and Climate Change**

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

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**The course instruction is implemented within the professional education programme of  
higher education:**

**Climate Projects Management**

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## 1. COURSE GOAL(s)

The course is designed to help students to obtain basics of the rationale and core concepts guiding an inclusive green economy, to provide students with knowledge, skills and abilities to operative as main actors in the progress and creation of both opportunities and challenges at global and national level to achieve sustainability, resource efficient and socially inclusive development.

### • 2. REQUIREMENTS FOR LEARNING OUTCOMES

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

Competence code	Competence descriptor	Competence formation indicators
GPC-3	Able to apply environmental research methods to solve research and applied problems of professional activity	GPC-3.1 knows the principles and methods of environmental monitoring related with different environmental components
		GPC-3.2 owns analytical methods of pollutants control, physical impacts and processing of the received information
		GPC-3.3 able to develop environmental monitoring and control systems in production and solve applied problems in professional activities
PC-1	Able to organize and manage the enterprise activities using in-depth knowledge in the field of greenhouse gas management	PC-1.1 knows the production and organizational structure of the organization, the regulatory framework for greenhouse gas management
		PC-1.2 able to organize the management of research, scientific, production and expert-analytical work at the enterprise
PC-5	Able to develop measures to minimize possible risks of climate change for conducting various types of economic activities	PC-5.1 able to identify direct/indirect sources of greenhouse gas emissions at all stages of the product life cycle

## 3. COURSE IN HIGHER EDUCATION PROGRAMME STRUCTURE

Discipline *Environmental Engineering and Climate Change* 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*
GPC-3	Able to apply environmental research methods to solve research and applied problems of professional activity	No	Carbon Test Areas and GHG Monitoring

<b>PC-1</b>	Able to organize and manage the enterprise activities using in-depth knowledge in the field of greenhouse gas management	International Standards for GHG Management	Industrial Internship
<b>PC-5</b>	Able to develop measures to minimize possible risks of climate change for conducting various types of economic activities	No	Industrial Internship Research Work (R&D) (obtaining primary skills of research work) Pre-graduate Internship

#### 4. COURSE WORKLOAD AND ACADEMIC ACTIVITIES

The total workload of the course 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	
Lab works					
Seminars (workshops/tutorials)	17			17	
<i>Self-study</i>	83			83	
<i>Evaluation and assessment (exam; pass/fail grading)</i>	27			27	
<b>The total course workload</b>	hours	<b>144</b>			<b>144</b>
	credits	<b>4</b>			<b>4</b>

#### 5. COURSE CONTENTS

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

Title of Course Modules	Content	Types of academic activities
1. Sustainability and circular economy	Basic principles of the circular economy. Circular economy model. Infrastructure of the circular economy. Theoretical foundations of the circular economy. Formation of the subject area, concept and features. The concept of "cradle to cradle". The model of the circular economy and the stages of its formation. Indicators of sustainable development in the field of waste management. Basic principles of the circular economy in the field of waste management.	L, S
2. Climate-neutral resource management	Contribution of the waste management sector to the Earth's climate. Water resources and climate change. Adaptation and mitigation strategies.	L, S
3. Cleaner production	Drinking Water treatment. Water properties, water treatment stages.	L, S

<b>Title of Course Modules</b>	<b>Content</b>	<b>Types of academic activities</b>
4. Green technologies in wastewater treatment	Basic characteristics of wastewater. Oil and grease. Other important wastewater characteristics. Aerobic, anoxic, anaerobic biological treatment. Aerobic biological treatment. Anoxic biological treatment. Anaerobic biological treatment. Microorganisms in wastewater. Biological cells. Ecology of biological wastewater treatment. Reaction kinetics.	L, S

## **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 educational / laboratory equipment, software and materials for mastering the course (if necessary)</b>
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.
Seminars	Classroom, equipped with a set of specialized furniture; whiteboard; a set of devices includes portable multimedia projector, laptop, projection screen, stable wireless	Microsoft Windows 7 corporate. License No. 5190227, date of issue March 16, 2010 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. RESOURCES RECOMMENDED FOR COURSE STUDY**

### *Main reading:*

1. Kanianska R. Green Growth and Green Economy. Textbook to the course Green growth and green economy. Belianum: Banská Bystrica. 2017 (available on TUIS)

### *Additional reading:*

1. Worldwatch Institute: State of the World 2015: Confronting Hidden Threats to Sustainability, Washington, DC (Island Press). – 2015-
2. Mazmanian D.A. and Kraft M.E. eds. Toward sustainable communities: Transition and transformations in environmental policy. MIT Press. – 2009.
3. Bina O. The green economy and sustainable development: an uneasy balance? // Environment and Planning C: Government and Policy. 2013. T. 31, no 6. URL: <https://doi.org/10.1068/c1310j>
4. Kasztelan A. Green growth, green economy and sustainable development: terminological and relational discourse // Prague Economic Papers. 2017. – T. 26. URL: <https://www.cceol.com/search/article-detail?id=686936>
5. Mikhno I., Koval V., Shvets G., Garmatiuk O., Tamošiūnienė R. Green economy in sustainable development and improvement of resource efficiency // Central European Business Review (CEBR). 2021. – T. 10. URL: <https://www.cceol.com/search/article-detail?id=941002>

*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](http://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/>
- [www.greengrowthknowledge.org](http://www.greengrowthknowledge.org) – Green Growth Knowledge Partnership
- [www.oecd.org](http://www.oecd.org) – Organisation for Economic Co-operation and Development
- [www.greeneconomycoalition.org](http://www.greeneconomycoalition.org) – Green Economy Coalition
- [www.gggi.org](http://www.gggi.org) – Global Green Growth Institute
- [www.eea.europa.eu](http://www.eea.europa.eu) – European environment agency
- [www.mnr.gov.ru](http://www.mnr.gov.ru) – site of the Ministry of Natural Resources of the Russian Federation;
- [www.unep.org](http://www.unep.org) – site of the United Nations Environment Programme;

## 8. ASSESSMENT TOOLKIT AND GRADING SYSTEM FOR EVALUATION OF STUDENTS' COMPETENCES LEVEL UPON COURSE COMPLETION

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  
ES&PQM Department

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Position

**Kurbatova A.V.**

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Signature

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Name, Surname

**HEAD OF DEPARTMENT:**

Director of ES&PQM Department

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**Savenkova E.V.**

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Position

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Signature

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Name, Surname

**HEAD OF PROGRAMME:**

Director of ES&PQM Department

**Savenkova E.V.**

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Position

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Signature

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Name, Surname

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**ASSESSMENT TOOLKIT**

**Environmental Engineering and Climate Change**

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**Recommended by the Didactic Council for the Education Field of:  
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Climate Project Management

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## Passport to Assessment Toolkit for Course Environmental Engineering and Climate Change

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

Course: Environmental Engineering and Climate Change

Competences (competences in part ) under assessment компетенции или ее части	Course module under assessment	Course topic under assessment	Tools to assess higher education programme mastering level								Exam/Pass-fail assessment	Points for topic	Points for course
			Class work				Self-studies						
			Quiz	Test	Work with lecture materials	Work at the seminars	Lab work	Homework	Research essay/ Library research paper	Calculation and graphic work			
GPC-3 PC-1 PC-5	Sustainability and circular economy	<p>Basic principles of the circular economy. Circular economy model.</p> <p>Infrastructure of the circular economy.</p> <p>Theoretical foundations of the circular economy.</p> <p>Formation of the subject area, concept and features.</p> <p>The concept of "cradle to cradle". The model of the circular economy and the</p>				12						4	



		stages of its formation. Indicators of sustainable development in the field of waste management. Basic principles of the circular economy in the field of waste management.												
GPC-3 PC-1 PC-5	Climate-neutral resource management	Contribution of the waste management sector to the Earth's climate. Water resources and climate change. Adaptation and mitigation strategies.				12							4	
GPC-3 PC-1 PC-5	Cleaner production	Drinking Water treatment. Water properties, water treatment stages.				12							6	
GPC-3 PC-1 PC-5	Green technologies in wastewater treatment	Basic characteristics of wastewater. Oil and grease. Other important wastewater characteristics. Aerobic, anoxic, anaerobic biological treatment. Aerobic biological treatment. Anoxic biological treatment. Anaerobic biological treatment. Microorganisms in wastewater. Biological cells. Ecology of biological wastewater treatment. Reaction kinetics.				12							8	
		<b>TOTAL</b>		<b>20</b>		<b>48</b>					<b>20</b>	<b>12</b>		

**Course Environmental Engineering and Climate Change**

**QUESTION CARD No 1**

QUESTION 1. Climate Change and Carbon Management

QUESTION 2. Drivers and Barriers to Cleaner Production

3 \* .....

**Developer** \_\_\_\_\_ (Kurbatova Anna)  
signature

Head of Educational Department \_\_\_\_\_ (Savenkova Elena)  
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 the difference between the concept of a Green Economy and Sustainable Development?
2. What are the implications of a Green Economy for poverty reduction?
3. What does the Green Economy imply for biodiversity conservation?
4. What implication does a Green Economy have on the notion of economic growth?
5. What work must be done during the transition to a green economy?
6. What goals have been identified for sustainable economic recovery after the pandemic?
7. What support has been shown for the We Are Still In Declaration, in agreement with the Paris Climate Agreement and its green economic goals?
8. Climate Change and Carbon Management
9. Biodiversity and Ecosystem Services
10. Green Technology and Renewable Energy
11. Environmental Law and Social Justice
12. Linkage between energy use, pollution and economic growth
13. Economic Indicators for Material Recovery Estimation
14. Assessment of mechanisms and instruments of climate finance
15. Challenges and opportunities at the crossroads of Environmental Sustainability and Economy research
16. Practices on Cleaner Production and Sustainability
17. Drivers and Barriers to Cleaner Production
18. Integrated process technology for recycling and re-use of industrial and municipal wastewater
19. Physicochemical–biotechnological approaches for removal of contaminants from wastewater

### 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, soundness and systematic nature of theoretical and practical knowledge gained by the student, formation of independent work skills, development of creative	Examples of tasks/questions/exam question cards

		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
<b><i>Self- studies</i></b>			
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	Set of tasks for standard calculations

		assignments for a module or discipline as a whole.	
6	Homework	<p>The tasks and assignments differ in terms of the following levels:</p> <p>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,</p> <p>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,</p> <p>c) creative level allows the teacher to evaluate and diagnose students' skills to integrate knowledge of various fields, argue their own point of view.</p>	Set of multi-level tasks and assignments with varying difficulty

# Department of Environmental Safety and Product Quality Management

## Set of assignments for control work

for the course Environmental Engineering and Climate Change

**What is the type of pollution where the pollutants reach the water body in points called?**

- a) Point-source pollution
- b) Diffuse pollution
- c) Point-source contamination
- d) Diffuse contamination

**Answer: a**

Explanation: In point-source pollution, the pollutants reach the water body in points concentrated in space. Usually, the discharge of domestic and industrial wastewater generates point-source pollution.

**What kind of molecule is water?**

- 1. Non-polar
- 2. Hydrogen
- 3. Polar

**Is water known as the universal solvent?**

- 1. Yes
- 2. No

**The Hydrogen atoms in H<sub>2</sub>O are considered positive in a water molecule**

- 1. Yes
- 2. No

**Why does ice float in water?**

- 1. Because of stronger hydrogen bonds at the surface
- 2. The density of water as a solid is less than the density of water as a liquid
- 3. Surface tension helps it float
- 4. It is more dense

**Assessment criteria:**

*(in compliance with the legal regulations in force)*

## Department of Environmental Safety and Product Quality Management

### Team-based or individual creative assignments/projects

for the course Environmental Engineering and Climate Change

Water pollution occurs when harmful substances—often chemicals or microorganisms—contaminate a stream, river, lake, ocean, aquifer, or other body of water, degrading water quality and rendering it toxic to humans or the environment.

Water is uniquely vulnerable to pollution. Known as a “universal solvent,” water is able to dissolve more substances than any other liquid on earth. It’s the reason we have Kool-Aid and brilliant blue waterfalls. It’s also why water is so easily polluted. Toxic substances from farms, towns, and factories readily dissolve into and mix with it, causing water pollution.

The purpose of the project is to assess the water pollution in the urban area.

#### Algorithm



This is Seine River in Paris. It flows very fast, its water is muddy. Please, describe all the possible sources of water pollution in the Siene.

**Task defense form – Power Point presentation of the report.**

#### **Assessment criteria:**

*(in compliance with the legal regulations in force)*

Developer \_\_\_\_\_ (Anna Kurbatova)  
signature

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day, month, year

**DEVELOPER:**

Associate Professor of the  
ES&PQM Department

Position

Signature

**Kurbatova A.I.**

Name, Surname

**HEAD OF DEPARTMENT:**

Director of ES&PQM Department

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**Savenkova E.V.**

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