

Документ подписан простой электронной подписью  
Информация о владельце:  
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Должность: Ректор  
Дата подписания: 17.05.2024 11:37:53  
Уникальный программный ключ:  
ca953a0120d891083f939673078ef1a989dae18a

**Federal State Autonomous Educational Institution for Higher Education  
PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA (RUDN University)  
named after Patrice Lumumba  
Institute of Environmental Engineering**

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## COURSE SYLLABUS

### Methodology of Scientific Creation

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

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

«Integrated Solid Waste Management» (Network program with L.N. Gumilyov Eurasian National University)

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## 1. COURSE GOAL(s)

The course is designed to help students to obtain the skills of conducting scientific research in environmental sciences. Formation of students' ideas about the planning of scientific work; methods and approaches to collecting materials, conducting experiments and processing results. Formation of skills for choosing the optimal methods for analyzing the data obtained during observations and experiments. Mastering the methods of presenting scientific information in conducting scientific research in the field of ecology.

## • 2. REQUIREMENTS FOR COURSE OUTCOMES

The course implementation is aimed at the development of the following competences:

Competence code	Competence descriptor	Competence formation indicators (within this course)
GC-1	Able to carry out a critical analysis of problem situations based on a systematic approach, develop an action strategy	GC-1.1 Knows how to solve problematic task and identify their components and relationships between them
		GC-1.2 Able to search for solutions to a problematic task based on available and reliable sources of information
		GC-1.3 Owns a strategy for solving a problem situation based on a systematic and interdisciplinary approach
GC-2	Able to manage a project at all stages of its life cycle	GC-2.1 Based on the problem posed, formulates a project task and a way to solve it through the implementation of project management
		GC-2.2 Develops the concept of the project within the framework of the designated problem (in the chosen professional field): formulates the goal, objectives, justifies the relevance, significance (scientific, practical, methodological and other depending on the type of project), expected results and possible areas of their application
		GC-2.3 Develops a project implementation plan using planning tools; develops and analyzes alternative project options to achieve the intended results
GC-3	Able to organize and manage the work of the team, developing a team strategy to achieve the goal	GC-3.1 Has the skills to control the fulfillment of requirements
		GC-3.2 Is able to develop a team work plan for activities aimed at meeting the requirements in the field of environmental protection, taking into account best practices
GC-6	Able to determine and implement the priorities of their own activities and ways to improve it based on self-assessment	GC-6.1 Able to determine and implement the priorities of their own activities and ways to improve it based on self-assessment
		GC-6.2 Able to analyze, synthesize and optimize solutions to the tasks
GC-7	Able to use basic knowledge in the field of information culture	GC-7.2 Formulates a real data processing problem in terms of a real problem

As a result of course studying, the student must:

**Know:**

- methodological approaches in environmental sciences;
- scientific paradigms;
- concepts of scientific creativity;

**Be able to:**

- formulate the problem of scientific research;
- identify and schematize cognitive methods in accordance with the problem;
- draw up a plan of scientific research in accordance with the task;
- use methodological approaches to analyze the results obtained;
- formalize and present scientific results;

**Own :**

- methods of conducting scientific research in environmental sciences;
- skills in organizing and conducting scientific research
- skills in choosing methods for testing scientific hypotheses
- skills in presenting data and conducting scientific discussions.

### 3. COURSE IN HIGHER EDUCATION PROGRAMME STRUCTURE

Discipline *Methodology of Scientific Creation* refers to the **mandatory part** (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*

<b>Competence code</b>	<b>Competence descriptor</b>	<b>Previous courses/modules, internships*</b>	<b>Subsequent courses/modules, internships*</b>
<b>GC-1</b>	Able to carry out a critical analysis of problem situations based on a systematic approach, develop an action strategy	-	Research work in the term including projects / Industrial / pedagogical Internship Research work on thesis State Exam degree Diploma
<b>GC-2</b>	Able to manage a project at all stages of its life cycle	IT in ecology and natural resources management	Research work in the term including projects / Industrial / pedagogical Internship Research work on thesis State Exam degree Diploma
<b>GC-3</b>	Able to organize and manage the work of the team, developing a team strategy to achieve the goal	-	Research work in the term including projects / Industrial / pedagogical Internship Research work on thesis State Exam

			degree Diploma
<b>GC-6</b>	Able to determine and implement the priorities of their own activities and ways to improve it based on self-assessment	-	Research work in the term including projects / Industrial / pedagogical Internship Research work on thesis State Exam degree Diploma
<b>GC-7</b>	Able to use basic knowledge in the field of information culture	Mapping and GIS-technologies in MSW Management Remote Sensing of MSW objects	Research work in the term including projects / Industrial / pedagogical Internship Research work on thesis State Exam degree Diploma

#### 4. COURSE WORKLOAD AND ACADEMIC ACTIVITIES

The total workload of the discipline is 3 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					
Lab works					
Seminars (workshops/tutorials)	22			22	
<i>Self-study</i>	75			75	
<i>Evaluation and assessment (exam; pass/fail grading)</i>	11			11	
<b>The total course workload</b>	hours	<b>108</b>		<b>108</b>	
	credits	<b>3</b>		<b>3</b>	

#### 5. COURSE CONTENT

Table 5.1. Course Modules and Contents

Title of Course Modules		Content	Types of academic activities
1.	Scientific research methods, their development in ecology.	Basic terms and definitions, structure of research activities, relevance and scientific novelty, classification of scientific research methods, tools for identifying problems, methods aimed at enhancing the use of experience and intuition of specialists, logical laws.	S
2	Introduction to Information Retrieval Theory	Information, types of information, ascending/descending information flows, the birth of information, the law of information dispersion. Search for information, search for information in the Internet, use of libraries and databases.	S

Title of Course Modules		Content	Types of academic activities
3	Empirical methods of knowledge	Methods of empirical knowledge, observation, measurement, measurement scales, measurement errors, the concept of an experiment, experiment planning, processing of experimental results, surveys, interviews, expert surveys, etc.	S
4	Methods and approaches to the analysis of the obtained data	Statistical and mathematical methods in ecology. Reliability and validity of the obtained data. Experiment, approaches to analysis. Collection and analysis of databases.	S
5	Presentation of scientific data	General requirements for research work, the basics of scientific citation, the effectiveness of scientific research, the concept of plagiarism in scientific activity, discoveries, their mechanism and typology.	S
	Final qualifying works	Thesis planning. Responsibilities of the head of the thesis. Structure and design of the thesis. Approaches to presenting thesis data. Presentation of the work.	S
	Research Article	Types of scientific articles. Types and ratings of journals. Citation index. Article writing approaches	S
	Conferences, symposiums, etc.	Types of scientific events. Purposes of participation in conferences, etc. Presentation of materials. Scientific discussion and its importance in promoting research, conducting scientific discussion.	S
	Financial support for research	Grants. Funds. Paid scientific activity within the framework of contracts. Grant application, execution and planning.	S
	Ethical aspects of scientific research in ecology	Ethical code of the ecologist. Rules of biological ethics in scientific research.	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)
Seminars	Classroom, equipped with a set of specialized furniture; whiteboard; a set of devices includes portable multimedia projector, laptop, projection screen, stable wireless	
Computer Lab	Computer Lab for conducting classes, group and individual consultations, current control and intermediate certification, equipped with personal computers (in the amount of 12), a board (screen) and technical devices of multimedia	Vensim PLE

Classroom for Academic Activity Type	Classroom equipment	Specialized educational / laboratory equipment, software and materials for mastering the course (if necessary)
	presentations.	
For Self-Study	Classroom for self-study (can be used for seminars and consultations), equipped with a set of devices includes laptop, stable wireless.	

## 7. RECOMMENDED SOURCES FOR COURSE STUDIES

### a) Main reading:

1. Prabhat Pandey, Meenu Mishra Pandey Research Methodology: Tools and Techniques Bridge Center 2015, 118 p
2. Lukáš Bielik Methodology of science an introduction Comenius University in Bratislava · 2019, 224 p.
3. C.R. Kothari Research Methodology. Methods and Techniques New Age International (P) Ltd., Publishers Published by New Age International (P) Ltd., Publishers, 2004, 418 p
4. Steve Lawrence and C. Lee Giles, NEC Research Institute Searching the Web: General and Scientific Information Access IEEE Communications Magazine ¥ January 1999, p 116-122

### b) Additional reading

1. Angela Repanovici Measuring the visibility of the University's scientific production using GoogleScholar, "Publish or Perish" software and Scientometrics WORLD LIBRARY AND INFORMATION CONGRESS: 76TH IFLA GENERAL CONFERENCE AND ASSEMBLY 10-15 August 2010, Gothenburg, Sweden <http://www.ifla.org/en/ifla76> ¶
2. Charles A. Ramsey,1 and Alan D. Hewitt A Methodology for Assessing Sample Representativeness *Environmental Forensics*, 6:71–75, 2005 DOI: 10.1080/15275920590913877
3. Gauch, H.G. (2003). Scientific method in practice. Cambridge University Press, UK.
4. Insight Media. (2010). How to Read and Understand a Research Study; Research Design: The Experiment; Research Design: The Survey; Research Ethics. DVDs of Science. Insight Media, New York, US.
5. National Academy of Sciences (U.S.). Committee on the Conduct of Science, National Academy of Engineering (1995). On being a scientist: responsible conduct in research. National Academies Press, Washington DC.
6. Wilson, E.B. (1991). An introduction to scientific research. McGraw-Hill, New York.

### *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"

1. Scientific Method: <http://emotionalcompetency.com/sci/booktoc.html>
2. Science Fair Project Ideas: <http://www.sciencebuddies.org/>  
[http://www.sciencebuddies.org/science-fair-projects/project\\_scientific\\_method.shtml](http://www.sciencebuddies.org/science-fair-projects/project_scientific_method.shtml)
3. An Introduction to Science: Scientific Thinking and the Scientific Method: <http://www.freeinquiry.com/intro-tosci.html>
4. Introduction to the Scientific Method: [http://teacher.nsrll.rochester.edu/phy\\_labs/AppendixE/AppendixE.html](http://teacher.nsrll.rochester.edu/phy_labs/AppendixE/AppendixE.html)
5. The Scientific Method: A helpful guide by Science Made Simple: [http://www.sciencemadesimple.com/scientific\\_method.html](http://www.sciencemadesimple.com/scientific_method.html)

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

Evaluation materials and a point- rating system\* for assessing the level of competence formation (part of competences) based on the results of mastering the discipline **Methodology of Scientific Creation** are presented in the Appendix to this Work Program of the discipline.

### DEVELOPER:

Senior Lecturer of the EM  
Department



**Kapralova D.O.**

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Position

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Signature

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Name, Surname

### HEAD OF DEPARTMENT:

Director of EM Department



**Kucher D.E.**

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Position

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Signature

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Name, Surname

### HEAD OF PROGRAMME:

Senior Lecturer of the ES&PQM  
Department



**Popkova A.V.**

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Position

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Signature

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Name, Surname

# **Department of Environmental Management**

educational department to be specified

APPROVED

Department meeting protocol No \_\_\_\_\_,

Dated \_\_\_\_\_

day, month, year

Head of Educational Department

\_\_\_\_\_ (Kucher D.E.)

signature

# **ASSESSMENT TOOLKIT**

**for the course**

## **Methodology of Scientific Creation**

course title

05.04.06 "Ecology and nature management"

field of studies / speciality code and title

«Integrated Solid Waste Management» (Network program with L.N. Gumilyov Eurasian National University)

higher education programme profile/specialisation title

**master**

graduate's qualification (degree)



## Passport to Assessment Toolkit for Course Methodology of Scientific Creation

Field of Studies / Speciality 05.04.06 "Ecology and nature management"

Course: Methodology of Scientific Creation

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	Seminar	Lecture	Homework	Article			
GC-1 GC-6 GC-7	Scientific research methods, their development in ecology.	Basic terms and definitions, structure of research activities, relevance and scientific novelty, classification of scientific research methods, tools for identifying problems, methods aimed at enhancing the use of experience and intuition of specialists, logical laws.	1	2		0,5	0,5			2	6	11
GC-1 GC-2	Introduction to Information Retrieval Theory	Information, types of information, ascending/descending information flows, the birth of information, the law of information dispersion.	1	2		0.5	0.5	3		1	6	6

		Search for information, search for information in the Internet, use of libraries and databases.										
	Empirical methods of knowledge	Methods of empirical knowledge, observation	1	2	0.5	0.5	3		2	6	6	
		Measurements, measurement scales, measurement errors										
		The concept of an experiment, experiment planning, processing of experimental results										
		Surveys, interviews, expert surveys										
	Methods and approaches to the analysis of the obtained data	Statistical and mathematical methods in ecology. Reliability and validity of the obtained data. Experiment, approaches to analysis. Collection and analysis of databases.	1	2	0,5	0,5	4		2	10	10	
<b>GC-1</b> <b>GC-2</b> <b>GC-3</b> <b>GC-6</b>	Presentation of scientific data	General requirements for research work, the basics of scientific citation, the effectiveness of scientific research	2	2	0.5	0.5			1	6	6	
		the concept of plagiarism in scientific activity										
		discoveries, their mechanism and typology.										
	Final qualifying works	Thesis planning. Responsibilities of the head of the thesis. Structure and design of the thesis.	2	2	0.5	0.5			1	6	6	
	Approaches to presenting thesis data											
	Presentation of the work.											

	Research Article	Types of scientific articles. Types and ratings of journals.	2	1		0,5	0,5		35	1	40	40
		Citation index.										
		Article writing approaches										
	Conferences, symposiums, etc.	Types of scientific events. Purposes of participation in conferences, etc. Presentation of materials. Scientific discussion and its importance in promoting research, conducting scientific discussion.	2	2		0,5	0,5			1	6	6
	Financial support for research	Grants. Funds. Paid scientific activity within the framework of contracts. Grant application, execution and planning.	2	2		0,5	0,5			1	6	6
	Ethical aspects of scientific research in ecology	Ethical code of the ecologist. Rules of biological ethics in scientific research.	2	2		0,5	0,5			2	7	7

# Passport to Assessment Toolkit for Course Methodology of Scientific Creation

Course Methodology of Scientific Creation  
course title

## QUESTION CARD No 1

QUESTION 1 What is the difference between sensory and rational knowledge?

QUESTION 2 Scientific revolutions as a bifurcation point in the development of knowledge

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signature

Head of Educational Department \_\_\_\_\_ (Kucher D.E.)  
signature

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day, month, year

## *EXAM QUESTIONS*

1. Define the term "creativity".
2. What is the peculiarity of technical creativity, invention?
3. Explain the concepts of "knowledge" and "information".
4. How do you understand the terms "relative knowledge", "absolute knowledge"?
5. What does the term "cognition" mean?
6. What is the difference between sensory and rational knowledge?
7. What objects of the surrounding world does a person learn indirectly?
8. Explain the path of the process of cognition from a scientific idea to a law or theory.
9. What is the law? theory? 10. Give examples of paradoxes, paradoxical phenomena.
10. Explain the concepts of "axiom", "postulate", "principle".
11. How do analysis and synthesis correlate in cognition?
12. What is induction and deduction?
13. What is characteristic of an analogy?
14. What are the advantages of the modeling method?
15. Explain the term "abstraction".
16. How are observation and scientific experiment related in cognition?
17. Explain the concepts of "intuition" and "logic".
18. What do the concepts "system" and "technical system" mean? 2
19. What is the peculiarity of theoretical knowledge?
20. What is the essence of physical modeling?
21. Features of mathematical modeling
22. Questions for the test Methodology of scientific research
23. Science as a cognitive activity, a system of knowledge, social institution and a special sphere of culture.
24. Subject and object of scientific research.
25. The place of scientific training of a specialist in the new educational paradigm.
26. Object and subject of research, choice of topic, drawing up plans, stages of work on a scientific topic.
27. Methodology for writing a report, theses, scientific article, diploma work.

28. Editing and reviewing scientific papers.
29. Information support for the scientific work of a specialist
30. Variety of forms of knowledge. The science.
31. Methods of empirical scientific research.
32. Methods of theoretical scientific research.
33. Methods of theoretical knowledge.
34. Methodological principles of organization of scientific work in the field economic security.
35. Basic methods for constructing scientific theories. 1
36. The structure of empirical knowledge.
37. Rethinking the philosophy of science today (based on journal articles).
38. Dynamics of scientific knowledge, growth models.
39. Scientific revolutions as a bifurcation point in the development of knowledge.
40. Value imperatives of science
41. Hermeneutics as a theory of interpretation.
42. The problem of truth in science.
43. Explanation, understanding and interpretation in natural and humanities. \Time, space, chronotope in social and humanitarian knowledge.. The nature of values and their role in social and humanitarian knowledge.
44. Specificity of the object and subject of social and humanitarian knowledge.
45. Ethics of science.
46. Ancient science.
47. Science in the Middle Ages
48. Classical science.
49. Formation in modern times of experimental and mathematical natural science, empirical and rationalistic philosophy.
50. . Non-classical science.
51. Post-non-classical science
52. The concept of the development of science K. Popper.
53. Methodology of research programs I. Lakatos.
54. The concept of scientific revolutions T. Kuhn.
55. The concept of personal knowledge M. Polanyi.
56. . Epistemological anarchism P. Feyerabend.
57. The concept of the influence of philosophy on science A. Koire. 37. Sociology of science M. Malkey. 38. Evolutionary theory of science S. Tulmin.
58. . Prerequisites for the emergence of experimental experience and its connection with natural science (Galileo, Bacon, Descartes).
59. Sociological and cultural approaches to research development of science
60. The problem of internalism and externalism in the development of science. 42. Genesis of science and the problem of periodization of its history
61. Levels of scientific knowledge.
62. Correlation between empiricism and theory in scientific knowledge.
63. Metatheoretical level of scientific knowledge.
64. Initial forms of conceptualization of social and humanitarian knowledge.
65. Historical types of rationality. post-non-classical rationality in social philosophy.
66. Research programs in social cognition.
67. Features of institutionalization in economic sciences.
68. Communications in science. Types of communications and communicative competence.
69. Communicative communities: scientific schools, paradigms

70. Values in philosophy and science.
71. Science as a social institution.
72. Traditions and innovations in scientific research (based on analysis of qualification work).
73. Responsibility of a scientist in the modern scientific community. 56. Philosophy of modern integration of science and production.
74. Scientific and technological progress and the moral responsibility of a scientist.
75. Scientific revolutions as a restructuring of the foundations of science.
76. . Global evolutionism and the modern scientific picture of the world.
77. Essence and specificity of philosophical and methodological problems in sphere of economic security.
78. Philosophical assessment of social, economic consequences scientific and technological progress
79. The role of the philosophy of non-violence in shaping the image of the future.
80. Solidarity and conflict in the social relations of people.
81. The role of social values in the choice of research strategies
82. . Types of knowledge and the problem of the source of scientific research.
83. . The specificity of the data of experience as the main content of the empirical basis of scientific knowledge. 68. Rules for the design of bibliography and footnotes in the thesis.
84. The structure of the thesis. Introduction: object, subject, goal, tasks. Requirements for the provisions submitted for defense.
85. . Methodological foundations of the thesis. Structure concepts in social cognition

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Head of Educational Department \_\_\_\_\_ (Kucher D.E.)  
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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)*

The assessment of all results of mastering competencies is carried out in accordance with the scale of the international point-rating system ECTS. In accordance with the calculated grading system, the student gains the required points.

Work in class: depends on the complexity of the topic. The grade is given for attendance and active work at a seminar or lecture (lectures are held in an interactive form) - answers to current questions, notes, discussion. The student is present at the lesson, participates in the discussion, does not hesitate to answer questions with a maximum score. The student is absent or the task is not prepared - 0 points.

Tasks of independent work: - acquisition of skills of independent practical work in the recommended software and application of various research methods; - developing the ability to independently and critically approach the material being studied. The IR technology should ensure the acquisition of knowledge, the consolidation and systematization of knowledge, the formation of skills and abilities. The proven technology is characterized by an algorithm that includes the following logically related student actions: - reading a text (textbook, manual, lecture notes); - note-taking of the text; - problem solving and exercises; - answers to control questions;

Final certification: A student is considered to have successfully passed the milestone or final certification if the total score for all activities at the time of certification exceeds 50% of the maximum possible score (lecture work, practical assignment, tests).

The final grade for the semester is added up as the sum of points for all types of student activities (\*see FOS passport) and can reach a maximum of 85 points,

The final test is given by the student voluntarily, if he scored the minimum possible score for certification - 51 points. In other cases, the test is mandatory and is estimated at a maximum of 15 points, as a result, the total score is derived taking into account the result of passing the test and the final grade corresponds to the international ECTS scale.

### 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, organized 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.	Colloquium	A tool for monitoring the acquisition and mastering of educational material on a topic, section or sections of a discipline, organised as a training session in the form of an interview among the teacher and students.	Questions on the course topics /modules
4	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
5	Lab work	The system of practice tasks aimed at the students' practical skills formation	Practice tasks bank
6.	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.
7	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
8.	Essay	A tool that allows the teacher to assess the student's ability to express in writing the essence of the under study, to independently analyse this issue using the concepts and analytical tools of the relevant discipline, to draw conclusions that summarise his/her position on the issue under consideration.	Themes for essays



9.	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
10	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
11	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 thinking, ability to synthesise the acquired knowledge and apply it to solve practice tasks.	Examples of tasks/questions/exam question cards
12	Internship and research and development (R&D) report	A form of written work that allows the student to generalise his/her knowledge, skills and abilities acquired during the introductory and advanced field internships, scientific and industrial internships and R&D activities.	
13	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
14	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,	Set of multi-level tasks and assignments with varying difficulty

		c) creative level allows to evaluate and diagnose students' skills to integrate knowledge of various fields, argue their own point of view.	
<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	Research essay (Library research paper)	The student's independent work in writing that summarises the results of the theoretical analysis of a certain scientific (educational and research) topic, where the author reveals the essence of the problem under study, considers different points of view, as well as argues his/her views on the material under consideration.	Themes for research essay ( library research papers)
5	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
6	Essay and other creative assignments	A partially regulated assignment that has a non-standard solution and allows the teacher to diagnose students' skills in integrating knowledge from various fields and arguing their own point of view; it can be prepared individually or by a group of students.	Themes for team-based or individual creative assignments
7	Standard calculations	A tool to test skills in applying the acquired knowledge, according to a predetermined	Set of tasks for standard calculations

		methodology, solving tasks or fulfilling assignments for a module or discipline as a whole.	
8	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

### CRITERIA FOR ASSESSING STUDENTS' KNOWLEDGE

Points BRS	Traditional grades in the Russian Federation	Points for transferring grades	Grades	ECTS grades
86 - 100	5	95 – 100	5+	A
		86 – 94	5	B
69 - 85	4	69 – 85	4	C
51 - 68	3	61 - 68	3+	D
		51 - 60	3	E
0 - 50	2	31 - 50	2+	FX
		0 - 30	2	F

#### Explanation of the rating table:

<b>A</b>	“Excellent” - the theoretical content of the course is mastered completely, without gaps, the necessary practical skills for working with the mastered material are formed, all the training tasks provided for by the training program are completed, the quality of their implementation is estimated by a number of points close to the maximum.
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<b>B</b>	“Very good” - the theoretical content of the course is mastered completely, without gaps, the necessary practical skills for working with the mastered material are basically formed, all the training tasks provided for by the training program are completed, the quality of most of them is estimated by a number of points close to the maximum.
<b>C</b>	“Good” - the theoretical content of the course has been mastered completely, without gaps, some practical skills in working with the mastered material are not sufficiently formed, all the training tasks provided for by the training program have been completed, the quality of none of them has been assessed with a minimum number of points, some types of tasks have been completed with errors.
<b>D</b>	“Satisfactory” - the theoretical content of the course has been partially mastered, but the gaps are not significant, the necessary practical skills for working with the mastered material are basically formed, most of the training tasks provided for by the training program have been completed, some of the completed tasks may contain errors.
<b>E</b>	“Mediocre” - the theoretical content of the course is partially mastered, some practical work skills are not formed, many training tasks provided for by the training program are not completed, or the quality of some of them is estimated by a number of points close to the minimum.
<b>FX</b>	“Conditionally unsatisfactory” - the theoretical content of the course has been partially mastered, the necessary practical skills have not been formed, most of the training tasks provided for by the training program have not been completed, or the quality of their implementation has been assessed with a number of points close to the minimum; with additional independent work on the course material, it is possible to improve the quality of the implementation of educational tasks.
<b>F</b>	“ Definitely unsatisfactory” - the theoretical content of the course has not been mastered, the necessary practical work skills have not been formed, all the completed training tasks contain gross errors, additional independent work on the course material will not lead to any significant improvement in the quality of the training tasks.

### **EXAMPLE OF A REVIEW WORK**

- 1) Name the research method and explain your conclusion (formalization, analysis and synthesis, induction and deduction, analogy, etc.)
- 2) Come up with the purpose of the study, the main objectives and the relevance of this study on the situation from the fairy tale about Cinderella.
- 3) On what basic philosophical principles is scientific activity based?
- 4) Think over the structure of UFO observations, determine the scale of measurements, funds of measuring instruments, conceptual means of observation, means of fixing observations.
- 5) Can an observation be wrong? Why. Explain.
- 6) Why is it necessary to carefully and in advance plan the experiment?
- 7) What does the Law of Information Dispersion say (in your own words)? How can it be applied in practice?
- 8) What is the difference between pertinence and relevance (in your own words)?

9) What is the main principle of the traditional classification of invention methods? What is the difference between the approach and TRIZ?

10) Is it possible to apply survey methods (questionnaires or interviews) in the natural sciences?

11) What is a sample? Why should we use different sample types?

12) Can we completely avoid measurement/experimental errors?

13) What are the basic principles for assessing the value of scientific work.

14) What is metrology?

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