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**Federal State Autonomous Educational Institution of Higher Education**

**PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA**

**RUDN University**

**Institute of Environmental Engineering**

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educational division (faculty/institute/academy) as higher education programme developer

## **COURSE SYLLABUS**

### **Fundamentals of scientific research**

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course title

**Recommended by the Didactic Council for the Education Field of:**

08.04.01 Construction

05.04.06. Ecology and environmental Management

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field of studies / speciality code and title

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

**Environmental Engineering in Construction**

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higher education programme profile/specialisation title

**2024 г.**

## 1. OBJECTIVE OF THE DISCIPLINE

The objectives of mastering the discipline "Fundamentals of scientific research" in accordance with the general objectives of the main professional educational program are:

- assimilation by students of knowledge about the methods of conducting scientific research;
- the formation of students' scientific understanding of the methods of collecting, processing, analyzing and presenting scientific information in scientific research.

The tasks of the discipline are:

- Development of students' ability to analyze the structural components of the scientific problem they study, the ability to establish their place and role in the system of society;
- Formation for students' scientific worldview,
- familiarization of students with the main methodological traditions and innovations;

improving the skills of organizing research activities.

## 2. REQUIREMENTS FOR THE RESULTS OF DISCIPLINE MASTERING :

Mastering the discipline "Fundamentals of scientific research" is aimed at developing the following competencies (parts of competencies):

*Table 2. Mastering the discipline "Fundamentals of scientific research" is aimed at developing the following competencies (parts of competencies):*

Code	Competencies	Competence achievement indicators (within this discipline)
GC-1	Able to carry out a critical analysis of problem situations based on a systematic approach, to develop a strategy of actions.	GC 1.1 Able to analyze a problem situation as a system, identifying its components and relationships between them
		GC 1.2 Owns argumentation and develops a meaningful strategy for solving a problem situation based on a systematic and interdisciplinary approach
		GC 1.3 Knows the basics of the strategy and identifies possible risks, suggesting ways to eliminate them
GPC 1а	Able to use philosophical concepts and methodology of scientific knowledge in the study of various levels of organization of matter, space and time	GPC 1а.1 Knows the relationship between the intuitive, the unconscious and the conscious in scientific creativity, the social and psychological motives of scientific creativity; problems of moral evaluation of scientific creativity; bioethics; integrative trends of modern knowledge
		GPC 1а.2 Uses the positions and categories of philosophy to evaluate and analyze various social trends, facts and phenomena related to the modern development

<b>Code</b>	<b>Competencies</b>	<b>Competence achievement indicators (within this discipline)</b>
		of natural science and technology
		GPC 1э.3 Owns the skills of historical and methodological analysis of scientific research and its results; all kinds of scientific communication; methods of conducting discussion and polemics, skills of public speech and written argumentative presentation of one's own point of view
GPC 2э	Able to use special and new sections of ecology, geoecology and nature management in solving research and applied problems of professional activity	GPC 2э.1 Has a systematic understanding of the theoretical and methodological foundations of environmental regulation
		GPC 2э.2 Knows the basic knowledge of the fundamental sections of biology in the amount necessary to master the basics in ecology and nature management
		GPC 2э.3 Owns modern methods of obtaining and evaluating geochemical information for solving theoretical and practical problems of environmental geochemistry in the field of ecology and nature management in order to protect the environment
PC 3	Able to carry out and organize scientific research of industrial and civil construction facilities, including in the field of environmental management	PC 3.1 Able to study the natural, technogenic, socio-economic, demographic and biomedical situation, search for cultural heritage objects in the study area, explore industrial and civil construction projects
		PC 3.2 Possesses the skills to perform studies of environmental objects, incl. industrial and civil engineering, chemical, microbiological, parasitological, toxicological indicators
		PC 3.3 Able to collect and analyze information about the natural and man-made environment, physical, geographical and climatic conditions, incl. in industrial and civil construction, based on materials from past years
GPC 1с	Able to solve the tasks of professional activity based on the use of theoretical and practical foundations, mathematical apparatus of fundamental sciences	GPC1с.1 Able to apply the theoretical and practical foundations of fundamental sciences in solving professional problems
		GPC1с.2 Able to apply the theoretical and practical foundations of fundamental sciences in solving professional problems
		GPC1с.3 Able to solve professional problems based on the use of knowledge of the mathematical apparatus of

<b>Code</b>	<b>Competencies</b>	<b>Competence achievement indicators (within this discipline)</b>
		fundamental sciences
GPC 6c	Able to carry out research of objects and processes in the field of construction and housing and communal services	GPC 6c.1 Able to conduct scientific and scientific-practical research in the field of construction and housing and communal services
		GPC 6c.2 Able to evaluate the scientific and technical results obtained in Russia and (or) abroad in new and (or) promising scientific areas in the field of construction and housing and communal services
		GPC6c.3 Has the skills to carry out research of objects and processes in the field of construction and housing and communal services

### 3. THE PLACE OF DISCIPLINE IN THE STRUCTURE OF EP HE:

The course "Fundamentals of scientific research "refers to the part formed by the participants of the educational relations of the block B1.

As part of the EP HE, students also master other disciplines and / or practices that contribute to the achievement of the planned results of mastering the discipline "Fundamentals of scientific research ".

*Table 3.1. The list of the components of the educational program that contribute to the achievement of the planned results of mastering the discipline*

<b>Code</b>	<b>Previous disciplines/modules, practices*</b>	<b>Subsequent disciplines/modules, practices*</b>
GC 1; GPC 1а; GPC 2а; PC 3; GPC 1с; GPC 6с	mathematics, logic, philosophy, psychology, sociology, probability theory, statistics	writing a master's thesis
GC 1; GPC 1а; GPC 2а; PC 3; GPC 1с; GPC 6с	mathematics, logic, philosophy, psychology, sociology, probability theory, statistics	
GC 1; GPC 1а; GPC 2а; PC 3; GPC 1с; GPC 6с	Philosophy, logic, generalecology	writing a master's thesis
GC 1; GPC 1а; GPC 2а; PC 3; GPC 1с; GPC 6с	Culturology, Pedagogy and Psychology	

GC 1; GPC 1a; GPC 2a; PC 3; GPC 1c; GPC 6c	Foreign language	
GC 1; GPC 1a; GPC 2a; PC 3; GPC 1c; GPC 6c	mathematics, probability theory, statistics	
GC 1; GPC 1a; GPC 2a; PC 3; GPC 1c; GPC 6c	Jurisprudence,	
GC 1; GPC 1a; GPC 2a; PC 3; GPC 1c; GPC 6c	Psychology, Culturology	
GC 1; GPC 1a; GPC 2a; PC 3; GPC 1c; GPC 6c	Annotation and summarizing, Culturology, foreign language, logic, general ecology, philosophy	writing a master's thesis
GC 1; GPC 1a; GPC 2a; PC 3; GPC 1c; GPC 6c	Special disciplines of the master's program	
GC 1; GPC 1a; GPC 2a; PC 3; GPC 1c; GPC 6c	Informatics, metrology, standardization and certification, statistics, probability theory, information technology	

#### 4. SCOPE OF DISCIPLINE AND TYPES OF EDUCATIONAL WORK

The total labor intensity of the discipline "*Fundamentals of scientific research*" is 2 credit.

*Table 4.1. Types of educational work by periods of mastering the EP HE for FULL-time education*

Type of educational work	TOTAL, ac.h.	Semester(s)			
		1	2	3	4
Contactwork, ac.h.	30		30		
including:					
Lectures (L)	30		30		
Laboratory work (LW)					
Practical/seminar classes (SC)					
Independent work of students, ac.h.	28		28		
Control (exam / test with assessment), ac.h.	14		14		

Type of educational work		TOTAL, ac.h.	Semester(s)			
			1	2	3	4
Total labor intensity of the discipline	ac.h.	72		72		
	credit	2		2		

Table 4.2. Types of educational work by periods of mastering the EP HE for CORRESPONDENCE forms education\*

Type of educational work		TOTAL, ac.h.	Semester(s)			
			1	2	3	4
Contactwork, ac.h.		6		6		
including:						
Lectures (L)		6		6		
Laboratory work (LW)						
Practical/seminar classes (SC)						
Independent work of students, ac.h.		62		62		
Control (exam / test with assessment), ac.h.		4		4		
Total labor intensity of the discipline	ac.h.	72		72		
	credit	2		2		

\* - filled in in case of implementation of the program in correspondence forms education

## 5. CONTENT OF THE DISCIPLINE

Table 5.1. Content of the discipline (module) by type of academic work

Name of the discipline section	Content of the section (topics)	Type of educational work*
<b>Topic 1.</b> Fundamentals of the methodology of scientific creativity	<i>Introduction to the methodology of scientific creativity, 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.</i>	L, PC

<b>Topic 2.</b> Introduction to Information Retrieval Theory	<i>Information, types of information, ascending/descending information flows, the birth of information, the law of information scattering. Search for information, search for information on the Internet, use of libraries and databases.</i>	L, PC
<b>Topic 3.</b> Empirical methods of knowledge	<i>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.</i>	L, PC
<b>Topic 4.</b> General requirements for the thesis	<i>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.</i>	L, PC
<b>Topic 5.</b> Other activities	<i>Methodology of practical activity, methodology of artistic and educational activity, organization of collective activity.</i>	L, PC

## 5.2. Practical classes (seminars)

№ п/п	№ of the discipline section	Topics of practical classes (seminars)	Laborintensity (hour)
1.	1	Relevance, scientific novelty, goals and objectives of the Final Qualifying Work (FQW) Problem identification tools  Methods aimed at activating the use of experience and intuition of specialists	3
2.	2	Search for information using various the database	2
3	3	Expert surveys (preparation of a scientific article)	5
4	4	Rules for writing FQW, information efficiency of FQW, Methods for calculating the percentage of personal participation  Types of discoveries.	5
5	5	Organization of collective activity	3

\* - filled in only for full-time education: L - lectures; LW - laboratory work; S - seminars.

## 6. MATERIAL AND TECHNICAL SUPPORT OF THE DISCIPLINE:

*Table 6.1. Material and technical support of discipline*

Classroom type	Classroom equipment	Specialized educational/laboratory equipment and materials for the discipline/module realization
Lecturehall	To organize the educational process, a classroom is used for conducting lecture-type classes, seminar-type classes, group and individual consultations, current control and intermediate certification, equipped with a set of specialized furniture; chalk board; technical means: HP PRO system unit, HP-V2072A monitor, LUMIEN retractable projection screen, with Internet access. Software: Microsoft products (OS, office suite, including MS Office/Office 365, Teams, Skype)	access to databases (Scopus, Pubmed, Sciecedirect)
For independent work of students	Computer class for conducting practical classes, course design, independent work.  A set of specialized furniture; marker board; technical means: personal computers (18.), projection screen, multimedia projector, NEC NP-V302XG, Internet access.  Software: Microsoft products (OS, office suite, including MS Office/Office 365, Teams, Skype)	access to databases (Scopus, Pubmed, Sciecedirect)

\* - the audience for independent work of students must be specified

## 7. EDUCATIONAL, METHODOLOGICAL AND INFORMATIONAL SUPPORT OF THE DISCIPLINE

### *Mandatory literature:*

1. Shai O, Reich Y, Hatchuel A, Subrahmanian E (2013) Creativity and scientific discovery with infused design and its analysis with C-K theory. Research in Engineering Design 24 (2):201-214. (the materials are posted on Research gate)
2. Ross, S. M., & Morrison, G. R. (2004). Experimental research methods. In Handbook of research on educational communications and technology (Vol. 2, pp., 1021–1043). Routledge. Taylor & Francis: [https://www.researchgate.net/publication/201382131\\_Experimental\\_Research\\_Methods](https://www.researchgate.net/publication/201382131_Experimental_Research_Methods)
3. Rules of preparation and registration of the final qualifying work of a student of the RUDN. (materials are posted on the RUDN educational portal).



***Additional literature:***

4. Noah, S.M., 2002. Research Methodology: Philosophy, Theory and Practice. University Putra Malaysia, Serdang, ISBN: 983-2373-38-7, pp: 85-96 (the materials are posted on Research gate)

a) software: Word, Excell, Powerpoint

б) databases (DB), information and reference and search systems: Yahoo, Infoseek, Lycos, Excite, LookSmart, Euroseek, AltaVista, АУ, Созвездие Интернет, Rambler, Апорт, WebRing 10.

**8. EVALUATION MATERIALS AND SCORE-RATING SYSTEM FOR ASSESSING THE LEVEL OF FORMATION OF COMPETENCES IN THE DISCIPLINE**

Evaluation materials and a score-rating system\* for assessing the level of competence formation (part of competencies) based on the results of mastering the discipline "Fundamentals of scientific research" are presented in the Appendix to this Work Program of the discipline.

\* The assessment toolkit and the grading system are formed on the basis of the requirements of the relevant local normative act of RUDN University (regulations / order).

**Developers:**

Associate Professor



Y.N. Rebouh

position, educational department

signature

name and surname.

**HEAD OF EDUCATIONAL DEPARTMENT:**

Director of the Department  
of Environmental Management



**Kucher D.E.**

educational department

signature

name and surname.

**HEAD OF  
HIGHER EDUCATION PROGRAMME:**

Director of the Department  
of Environmental Management



**Kucher D.E.**

position, educational department

signature

name and surname



**Department** \_\_\_\_\_

educational department to be specified

**APPROVED**

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

Dated \_\_\_\_\_

day, month, year

**Head of Educational Department**

\_\_\_\_\_(name and surname)

signature

# ASSESSMENT TOOLKIT

**for the course**

Fundamentals of scientific research

\_\_\_\_\_

course title

08.04.01 Construction, 05.04.06.Ecology and environmental Management

\_\_\_\_\_

field of studies / speciality code and title

Environmental Engineering in Construction

\_\_\_\_\_

higher education programme profile/specialisation title

master's

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graduate's qualification (degree)

## Passport to Assessment Toolkit for Course

Fundamentals of scientific research

Field of Studies / Speciality 08.04.01 Construction, 05.04.06. Ecology and environmental Management

Course: Fundamentals of scientific research

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
			Current control				certification intermediate	Final certification exam		
			Work in class	Practical class	Homework	Control work				
GC 1; GPC 1a; GPC 2a.1; GPC 2a; GC 3; GPC 1c; GPC 6c	Module 1: Fundamentals of the methodology of scientific creativity	Topic 1: Introduction to the scientific research methodology, basic terms and definitions, structure of research activities, relevance and scientific novelty.	1	1	5	2		5	9	18
		Topic 2: classification of scientific research methods, tools for identifying problems,	1	1	5	2			9	

		methods aimed at enhancing the use of experience and intuition of specialists, logical laws.								
GC 1; GPC 1a; GPC 2a.1; GPC 2a; GC 3; GPC 1c; GPC 6c	Module 2: Introduction to Information Retrieval Theory	Topic 1: Information, types of information, ascending/descending information flows, the birth of information, the law of information dispersion. Search for information	0,5	0,5		1		5	2	8
		Topic 2: Search for information on the Internet, basics of Internet search, classification of IRS, pertinence and relevancy.	0,5	0,5	5	1			6	
GC 1; GPC 1a; GPC 2a.1; GPC 2a; GC 3; GPC 1c; GPC 6c	Module 3: Empirical methods of knowledge.	Topic 1: Methods of empirical knowledge	0,5	0,5		1		5	2	21
		Topic 2: observation	1	1		1			3	
		Topic 3: measurement, measurement scales, measurement errors	1	1		1			3	
		Topic 4: the concept of an experiment, planning an experiment, processing the results of an experiment	1	1		2			4	
		Topic 5: surveys, interviews	0,5	0,5		1			2	
		Topic 6: expert surveys	0,5	0,5	5	1			7	
GC 1; GPC 1a; GPC 2a.1; GPC 2a; GC 3; GPC 1c; GPC 6c	Module 4: General requirements for the thesis	Topic 1: General requirements for research work	0,25	0,25	5	1		5	6,5	18
		Topic 2: science citation basics	0,25	0,25		0,5			1	
		Topic 3: effectiveness of scientific research	0,25	0,25	5	1			6,5	
		Topic 3: the concept of plagiarism in scientific activity	0,25	0,25		1			1,5	

		Topic 3: discoveries, their mechanism and typology.	0,5	0,5		1,5			2,5	
GC 1; GPC 1а; GPC2а.1; GPC 2а; GC 3; GPC 1с; GPC 6с	Module 5:Otheractivities	Topic1:Practice Methodology	0,25	0,25		0,5			1	
		Topic 2: Methodology of artistic and educational activities	0,25	0,25		0,5			1	
		Topic 3: organization of collective activities	0,5	0,5	5	1		5	7	9
<b>ИТОГО:</b>			<b>10</b>	<b>10</b>	<b>35</b>	<b>20</b>	<b>32</b>	<b>25</b>		<b>100</b>

**Course:** Fundamentals of scientific research

course title

## **QUESTION CARD No**

QUESTION 1 Give a definition of scientific research

QUESTION 2 What does the IMRaD system mean?

QUESTION 3 What should the introduction section of a scientific paper contain?

QUESTION 4 What should the abstract section of a scientific paper contain?

QUESTION 5 What does topic novelty mean? And how can we define it ?

QUESTION 6 What types of scientific papers exist and what is the difference between them?

**Developer**\_\_\_\_\_ (name and surname)

signature

Head of Educational Department\_\_\_\_\_ (name and surname)

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)*



**Department** \_\_\_\_\_

educational department to be specified

## **Set of assignments for control work**

for the course \_\_\_\_\_

course title

**Theme:**writing scientific articles

**Variant 1:** overview

Task 1: find relevant sources.

**Theme 2:**keywords use .

**Variant 1:** bibliographical research.

Task1: check multiple databases by using keywords.

**Theme 3:** novelty of the topic

**Variant 1:** what does topic novelty mean and how do you define it?

Task 1:definition of the novelty of the topic

**Theme 4:** introduction section writing

**Variant 1:** what is the introduction content of a scientific paper?

Task 1:introduction writing

**Theme 5:** Discussion section writing

**Variant 1:** What is the discussion content of a scientific paper?

Task 1:Discussion of results

**Assessment criteria:**

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

Developer \_\_\_\_\_ (name and surname)

signature

**Department** \_\_\_\_\_

educational department to be specified

**Themes for essays**

**(research essay/library research papers\*, reports, briefs)**

for the course \_\_\_\_\_

course title

1. Scientific research methodology
2. Citation methodology
3. IMRaD System (Introduction, Methods, Results, and Discussion)
4. literature review methodology

5. Find relevant sources.
6. Collect the necessary data from sources.
7. Use keywords.
8. Check multiple databases.

**Assessment criteria:**

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

Developer \_\_\_\_\_ (name and surname)

signature

\_\_\_\_\_

\*Requirements for library research papers can be found at

<https://custom-writing.org/blog/library-research-paper>

<https://www.cambridge.org/core/books/abs/psychologists-companion/steps-in-writing-the-library-research-paper/D4AFF7400D158C124F58EC71E2E7B004>