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**Federal State Autonomous Educational Institution for Higher Education  
Peoples' Friendship University of Russia named after Patrice Lumumba  
(RUDN University)  
Engineering Academy**

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

**Base Department "Power Engineering"**

(department realizing the PhD program)

**COURSE SYLLABUS**

**Research Methodology**

(course title)

**Scientific specialty:**

**2.4.7 Turbomachines and Piston Engines**

(scientific specialty code and title)

**The course instruction is implemented within the PhD programmes:**

**Turbomachines and Piston Engines**

(PhD program title)

## **1. DISCIPLINE (MODULE) GOAL**

The purpose of mastering the discipline "Methodology of scientific research" is the preparation for the candidate's examinations, as well as the acquisition of knowledge, skills and experience in the research field, characterizing the stages of the formation of competencies and ensuring the achievement of the planned results of mastering the educational program.

The main objectives of the discipline are:

- teaching the basics of scientific research methodology;
- formation of modern ideas about research related to power engineering;
- formation of ideas about the basic concepts, stages, logic of scientific research;
- explanation of the theoretical foundations of the strategy for conducting scientific research in the field of production, distribution of thermal energy, control of its flows and conversion of other types of energy into heat;
- training in effective monitoring and diagnostics of the most pressing problems in the chosen specialization.
- formation of skills for the correct presentation and design of scientific papers of a different nature;

## **2. REQUIREMENTS TO PHD-STUDENTS ON FINISHING THE COURSE**

Mastering the discipline "Methodology of scientific research" is aimed at preparing for the candidate's examinations, as well as mastering the following competencies:

Know:

- methods for critical analysis and evaluation of modern scientific achievements, as well as methods for generating new ideas in solving research and practical problems, including in interdisciplinary areas
- the main concepts of modern philosophy of science, the main stages of the evolution of science, functions and foundations of the scientific picture of the world
- features of presenting the results of scientific activities in oral and written form when working in Russian and international research teams
- know the main range of problems (tasks) encountered in the chosen field of scientific activity, and the main methods (methods, algorithms) for solving them;
- the main sources and methods of searching for scientific information on the issues under study.
- methodological approaches to conducting theoretical and experimental research;
- principles of organization of theoretical and experimental research.

Be able to:

- analyze alternative options for solving research and practical problems and evaluate the potential gains / losses of the implementation of these options;
- when solving research and practical problems, generate new ideas that can be operationalized based on available resources and constraints.
- use the provisions and categories of the philosophy of science for the analysis and evaluation of various facts and phenomena

- follow the norms accepted in scientific communication when working in Russian and international research teams in order to solve scientific and educational problems;
- make personal choices in the process of working in Russian and international research teams, evaluate the consequences of the decision made and be responsible for it to yourself, colleagues and society
- find (choose) the most effective (methods) for solving the main types of problems (tasks) encountered in the chosen field of scientific activity;
- analyze, systematize and assimilate the best practices in scientific research.

Own:

- analysis of methodological problems that arise when solving research and practical problems, including those in interdisciplinary areas;
- critical analysis and evaluation of modern scientific achievements and results of activities to solve research and practical problems, including in interdisciplinary areas.
- analysis of the main ideological and methodological problems, incl . interdisciplinary character arising in science at the present stage of its development;
- ownership of planning technologies in professional activities in the field of scientific research.
- effective analysis of the main ideological and methodological problems, incl . interdisciplinary nature arising from work on solving scientific and educational problems in Russian or international research teams;
- technologies for evaluating the results of collective activities to solve scientific and educational problems, including those conducted in a foreign language;
- technologies for planning activities in the framework of work in Russian and international teams to solve scientific and scientific and educational problems;
- various types of communications in the implementation of work in Russian and international teams to solve scientific and scientific and educational problems.
- modern methods, tools and technologies of research activities;
- skills in preparing and implementing a program of theoretical and experimental research

### 3. WORKLOAD OF THE DISCIPLINE AND TYPES OF ACTIVITIES

The total complexity of the discipline " Methodology of scientific research" is 1 credit unit.

*Table 3.1. Types of educational work by periods of mastering the postgraduate program*

| Type of study work                            |           | TOTAL<br>, acc.h. | semester<br>2 |
|---|-----------|-------------------|---------------|
| <i>Contact work, acc .</i>                    |           | 18                | 18            |
| including:                                    |           |                   |               |
| Lectures ( <b>LK</b> )                        |           | 12                | 12            |
| Practical/seminar sessions ( <b>SZ</b> )      |           | 6                 | 6             |
| <i>Independent work of students, acc .</i>    |           | 18                | 18            |
| <i>Control (test with assessment), acc .</i>  |           |                   |               |
| <b>The total complexity of the discipline</b> | ac.h.     | <b>36</b>         | <b>36</b>     |
|   | credit.ed | <b>1</b>          | <b>1</b>      |

#### 4. CONTENT OF THE DISCIPLINE

*Table 4.1. The content of the discipline (module) by type of educational work*

| <b>Name of the discipline section</b>          | <b>Contents of the section (topic)</b>   | <b>Type of study work</b> |
|--|--|---------------------------|
| Methodological foundations of research work    | The structure of scientific knowledge. Forms of organization of scientific knowledge. Sources and conditions of research search. Concepts and functions of the methodology in relation to power engineering  | LK, SZ                    |
| Fundamentals of organizing scientific research | Definition of the object, subject, hypothesis, purpose and objectives of the study in relation to turbomachines and piston engines. Research methodology, research topic and its relevance. Formulation of contradictions and the main problem. Research methods and techniques applicable to geosciences. Methods of theoretical research. Statistical methods and means of formalization | LK, SZ                    |
| Logic in research work                         | Stages of designing the logic of research: staging, actual research and design and implementation  | LK, SZ                    |
| Presentation of scientific work                | Formulation of research results. Presentation of research work. Scientific text: characteristic. Types, forms of presentation. Formulation of research results. Presentation of research work. Scientific text: characteristic. Types, forms of presentation. Thesis as a specific type of scientific text   | LK, SZ                    |

#### 5. EQUIPMENT AND TECHNOLOGY SUPPORT REQUIREMENTS

*Table 5.1. Logistics of discipline*

| <b>Audience type</b> | <b>Audience equipment</b>   | <b>Specialized educational / laboratory equipment, software and materials for mastering the discipline (if necessary)</b> |
|----------------------|---|---|
| Lecture              | An auditorium for lecture-type classes, equipped with a set of specialized furniture; board (screen) and technical means of multimedia presentations.   | projector, screen, computer, chalkboard   |
| Seminar              | An auditorium for conducting seminar-type classes, group and individual consultations, current control and intermediate certification, equipped with a set of specialized furniture and technical means for multimedia presentations. | projector, screen, computer, chalkboard   |

| Audience type                    | Audience equipment   | Specialized educational / laboratory equipment, software and materials for mastering the discipline (if necessary) |
|----------------------------------|--|--|
| For independent work of students | An auditorium for independent work of students (can be used for seminars and consultations), equipped with a set of specialized furniture and computers with access to the EIOS. | projector, screen, computer, chalkboard  |

\* - the audience for independent work of students is required!

## 6. METHODOLOGICAL SUPPORT AND LEARNING MATERIALS

### *Main literature:*

Ruzavin G.I. Methods of scientific research. - M.: Thought, 1974 - Access mode: [http://nashaucheba.ru/v16914/ruzavin\\_g.i.\\_methodology\\_scientific\\_research](http://nashaucheba.ru/v16914/ruzavin_g.i._methodology_scientific_research);

2. Zimnyaya I.A., Shashenkova E.A. Research work as a specific type of human activity. - Moscow-Izhevsk, 2001 - Access mode: <https://gigabaza.ru/doc/66553.html>;

3. Novikov A.M. Scientific and experimental work in an educational institution. - M.: Association "Professional Education", 1996 - Access mode: <http://anovikov.ru/books/nauch.pdf>

### *Additional literature:*

1. Sohor A.M. The logical structure of the educational material. - M., 1974 - Access mode:

<https://yandex.ru/search/?text=Sohor%20A.M.%20Logical%20structure%20educational%20material.%20-%20M.%20C%201974&lr=213&clid=2270455&win=320>

2. Arister N.I., Zaguzov N.I. The procedure for preparing and defending dissertations. - M.: AOZT "IKAR", 1995 - Access mode: <http://biblioclub.ru/index.php?page=book&id=469595>;

3. Burdin K.S., Veselov P.V. How to write a scientific paper. - M.: Higher School, 1973 - Access mode: <https://b-ok.org/book/3021321/c03eab>;

4. Kuzin F.A. Dissertation: Methodology of writing. Design rules. Protection order. A practical guide for doctoral students, graduate students and undergraduates. -2nd ed., add. - M.: Os-89, 2001 - Access mode: [http://nashaucheba.ru/v46189/kuzin\\_f.a.\\_dissertation\\_writing\\_method.\\_format\\_rules.\\_protection\\_order](http://nashaucheba.ru/v46189/kuzin_f.a._dissertation_writing_method._format_rules._protection_order).

### *Resources of the information and telecommunications network "Internet":*

1. RUDN ELS 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/](https://www.yandex.ru/)
- Google search engine <https://www.google.ru/>
- abstract database SCOPUS [http:// www .elsevierscience.ru/ products / scopus /](http://www.elsevierscience.ru/products/scopus/)

*Educational and methodological materials for independent work of students in the development of the discipline/module\*:*

1. A course of lectures on the discipline "Methodology of scientific research".
2. Guidelines for self-study

\* - all educational and methodological materials for independent work of students are placed in accordance with the current procedure on the page of the discipline in TUIS!

## **7. ASSESSMENT TOOLKIT AND GRADING SYSTEM FOR MIDTERM ATTESTATION OF STUDENTS IN THE DISCIPLINE (MODULE)**

Assessment toolkit and a grading system to evaluate the level of competences (competences in part) formation as the course results are specified on the TUIS platform.

### **DEVELOPERS:**

Associate Professor of the  
Department of Power  
Engineering

Position, BUP

Signature

Oshchepkov P.P.

Surname I.O.

### **HEAD OF BUP:**

Department of Power  
Engineering

Name of BUP

Signature

Radin Yu.A.

Surname I.O.