**ANNOTATION**

**of a syllabus for**

**RESEARCH METHODOLOGY**

1. **Total labor intensity** *(in Credit Units) –5 ECTS.*
2. **Course sequencing**

The discipline belongs to the module of mandatory professional disciplines of the educational program.

This discipline is based on basic knowledge, skills and abilities formed upon obtaining a previous level of education.

The knowledge, skills and abilities formed by this discipline will be required when mastering the following elements of the educational program:

* Professional and Academic Communication in Computer Science / Comunicación profesional y académica en informática;
* Research project;
* Work placement and Pre-graduation internship.

1. **Course aims**

Purposes of mastering the discipline:

* formation of students' knowledge about methodological problems of science and methods of scientific research, methods of organizing and conducting research activities;
* developing students' skills in using scientometric systems to identify current scientific trends, conducting analytical reviews using databases of scientific publications and other results of intellectual activity, preparing reports on the results of research and search activities.

Objectives of mastering the discipline:

* to form a detailed insight into terminology of scientific research, theoretical and empirical methods of scientific research, their area of application and possibilities in the preparation of a master's thesis;
* to develop skills for conducting analytical reviews using databases of scientific publications and patents;
* to develop skills of independent analysis of global scientific trends using scientometric systems;
* to develop skills in preparing research reports in accordance with the standards, norms and rules adopted in the professional field.

1. **Course contents**

**Module 1. Methodology, conducting scientific research**

**1. Research methodology.**

The history of methodology of science. Its development and the current state of the problem. Research methodology. A concept, types, interdisciplinary nature.

The main categories of methodological sciences. Ways to form a scientific problem.

Methods for formulating hypothesis and research concepts. Stages of formulating a hypothesis. Determination of a target of research and a research object, goals, research objectives. General research scheme.

Analysis of problem, hypothesis and concept formulation examples in research and development.

Features of individual and collective research. Scientific research tools. Examples of problem statement, definition of target functions and mathematical models.

**2. Conducting research.**

Definitions of research in the legislation of the Russian Federation and normative and technical documentation. The place of research in the life cycle of a product. Types of research, their characteristics.

The goals and objectives of research. Types of work carried out within the framework of research. The main stages of research. General requirements for the organization and implementation of research.

Terms of reference for research, its content. Technical proposal. Preliminary design. Technical project. Research results. A research report, the structure of a report. Acceptance of research stages.

Patent research. The procedure for conducting patent research.

The main ways of planning and implementing research and development. Study and analysis of practical real examples of the implementation of research in computer science. Problems of a systematic approach in planning development work. Study of the problem of transdisciplinary methodology.

**Module 2. Working with databases of scientific articles and patents**

**3. Systems of objective assessment of the analysis of publication activity and citation of researchers**

Methods for assessing the analysis of publication activity and citation of researchers. Problems of assessing the contribution of scientists to science and approaches to their solution. Research of statistics of publication activity. Impact factor is a numerical indicator of the citation of articles.

**4. The application of domestic and foreign databases of scientific results**

Researchers identifiers in the RSCI, Scopus and Web of Science databases. Possibilities of using the Science Index system to assess the publication activity of researchers. Intelligent tools for tracking, analyzing and visualizing research in Scopus and Web of Science databases. Rospatent and information resources of Rospatent. Information retrieval system FIPS and tips of handling it. Review of databases of the world's leading patent offices.

**Module 3. The use of scientometric systems**

**5. Scientometric methods for the analysis of scientific trends**

Global trends and frontiers in science. Sources and types of trends: research fronts, grant and patent landscape, emerging technologies. Scientometric methods. Citation, bibliographic combination, co-citation. Research fronts, science map. Relevance metrics. Co-occurrence of terms. Analysis of the dynamics of the subject area. Scientific communication networks. Research team, scientific school, invisible college.

**6. Analysis of scientific trends via scientometric systems**

Analysis of the structure of the invisible college, maps of research competencies and prominence of topics in SciVAL. Analysis of the publication, grant and patent landscape in Dimensions.

**Module 4. Design standards for research reports**

**7. Design standards for research reports**

The structure and rules for preparing a research report (GOST (State Standard) 7.32–2017). Design standards for bibliographic records and their elements (GOST (State Standard) 7.1-2003, GOST R (State Standard) 7.0.100-2018, GOST R 7.0.5-2008).

**8. Preparation of research reports**

The structure and rules for design a reserach report. Preparation of a research report in Microsoft Word using styling and document templates. Using automatic numbering of objects (figures, tables, formulas), cross-references to objects (figures, tables, formulas, information sources, etc.), automatically collected tables of contents, subject indexes in Microsoft Word. Collaboration with documents in Microsoft Word. General information about the LaTeX publishing system. LaTeX application for writing scientific articles and reports. Preparation of a research report in LaTeX.

1. **List of intended learning outcomes correlated with competence**

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| **Competence** | **Indicators** | **Learning outcomes** |
| UC-1. Able to carry out a critical analysis of problem situations based on a systematic approach, develop an action strategy | UC-1.1 Applies a systematic approach and carries out a critical analysis of problem situations | **Knowledge:**  - fundamentals of research and development methodology  - cases based on a systematic approach |
| **Abilities:**  - apply a systematic approach when performing research |
| **Skills:**  - critical analysis in terms of problem situations |
| UC-1.2 Develops the action strategy to achieve the goal | **Knowledge:**  - the action strategy to achieve the goal |
| **Abilities:**  - develop the action strategy when performing research |
| **Skills:**  - development of the ideology of the life cycle of a scientific project |
| UC-4. Able to apply modern communication technologies, including in a foreign language (s), for academic and professional interaction | UC-4.1 Uses information and communication technologies for academic and professional interaction | **Knowledge:**  - information and analytical systems for the operational provision of scientific research with relevant reference and bibliographic information and for assessing the effectiveness and efficiency of research organizations, scientists;  - scientometric tools, services, platforms;  - the basic concepts of a research team, a scientific school and an invisible college as forms of academic interaction |
| **Abilities:**  - handling leading databases of scientific papers and patents;  - apply scientometric tools for the analysis of scientific communication networks |
| **Skills:**  - search, processing and analysis of information from leading databases of scientific articles and patents in Russia and the world;  - visualization and analysis of scientific communication networks based on the competence map of leading scientists and organizations in the subject area. |
| GPC-1. Able to independently analyze information, acquire, develop and apply  mathematical, natural science, interdisciplinary and professional knowledge  for solving non-standard tasks | GPC-1.1. Analyzes information independently as well as provides problem statement and formalizes tasks in the professional field | **Knowledge:**  - new and existing scientific achievements for the analysis and formulation of the research problem  - work with information systems for data analysis  **Abilities:**  - to carry out the formulation and formalization of tasks in the professional sphere  - independently analyze information and get informed conclusions  **Skills:**  - work with information systems of scientific databases and patent offices |
| GPC-1.2. Uses mathematical, natural science and socio-economic knowledge to solve non-standard problems in professional activities | **Knowledge:**  - methods of solving non-standard tasks in professional activity  - mathematical foundations of scientometrics |
| **Abilities:**  - to work with Russian and foreign scientific and patent databases  - apply scientometric methods of mapping science and analyzing the dynamics of the subject area |
| **Skills:**  - conducting analytical reviews of scientific results in the interdisciplinary context of the tasks of professional activity |
| GPC-1.3. Independently acquires and develops knowledge in the professional field, including in an interdisciplinary context | **Knowledge:**  - specifics of registration of intellectual property in various countries of the world  - sources and types of trends, including scientific activity |
| **Abilities:**  - search and analyze information in the databases of the world's leading patent offices  - apply scientometric methods and analytical tools for independent analysis of scientific trends |
| **Skills:**  - work with patent information resources  - visualization and analysis of global scientific trends using scientometric systems |
| GPC-2. Able to structure and present the results of research and development, including results in the form of analytical reviews with substantiated conclusions and recommendations | GPC-2.1. Analyzes and structures the results of research and development | **Knowledge:**  - principles of presentation of research results |
| **Abilities:**  - structure the results of research in accordance with the principles of preparing research reports  - prepare analytical reviews with sound conclusions |
| **Skills:**  - preparation of reports on research results in the form of an analytical review |
| GPC-2.2. Presents the results of research and development in accordance with the standards, norms and rules adopted in the professional field | **Knowledge:**  - principles for preparing research reports and development in accordance with State Standard (GOST) 7.32–2017;  - rules for formatting bibliographic descriptions and bibliographic references in accordance with State Standard GOST 7.1-2003, GOST R 7.0.100-2018, GOST R 7.0.5-2008;  - principles of effective preparation of R&D reports in Microsoft Word office suite and LaTeX publishing environment; |
| **Abilities:**  - formalize the results of research activities in accordance with the standards, norms and rules; |
| **Skills:**  **-** preparation of reports on the results of research work. |

1. **Additional useful information**

The discipline provides for the following teaching methods and interactive forms of conducting classes:

1. visualization of educational material (presentations of lecture material are available in the ICTIS e-learning system (lms.sfedu.ru);
2. discussion (discussion of new information technologies);
3. group work (work in small groups in practical classes while searching for information sources and identifying scientific trends);
4. master classes (work with databases of scientific publications and patents, work with scientometric systems, work in Microsoft Office Word, work in the LaTeX publishing system).

Along with traditional educational technologies, e-learning technologies and distance educational technologies in the electronic information and educational environment of the Southern Federal University can be used to implement the discipline. Lectures and other forms of contact work between students and the lecturer can be conducted using the platforms Microsoft Teams, Cisco, Moodle (BigBlueButton), etc., which allows for online and offline interaction between the teacher and the students within the discipline.

The main methods of current control are electronic recording and monitoring of students' educational achievements (using the service of the point-rating system; maintaining an electronic journal of progress, conducting electronic testing and using other controls using the e-learning system).

**Summative Assessment method:** 1 semester – differentiated credit.