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|  | **Course Syllabus** |

**1.** **Course Title:**

Research methodology

**2. Academic Level:**

Master

**3. ECTS Credits:**

5 ECTS

**4. Semester:**

1, autumn semester

**5. School/Department:**

Institute of Computer Technologies and Information Security

**6. Location:**

Building “И”, 2 Chekhov St., Taganrog

**7. Instructor:**

Associate Prof., Dr. Evgeniya Gerasimenko, email: egerasimenko@sfedu.ru

**8. Language of Instruction:**

English

**9. Course Description:**

 This course provides the base of knowledge that the following courses subsequently build upon:

* Professional and Academic Communication in Computer Science;
* Research project;
* Internship, pre-graduate training.

**10. Course Aims:**

* To form students' knowledge about methodological problems of science and methods of scientific research, methods of organizing and conducting research activities;
* To develop 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 and preparing research reports.

**11. Specific entry requirements (if any):**

The level of English B1 and higher

**12. Course Content:**

**13. Intended Learning Outcomes:**

**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).

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| **Competence** | **Learning outcomes** |
| *Able to carry out a critical analysis of problem situations based on a systematic approach, develop an action strategy* | **Knowledge and understanding of:**   * fundamentals of research and development methodology * cases based on a systematic approach   **Abilities:**   * to apply a systematic approach when performing research   **Skills:**   * critical analysis in terms of problem situations |
| **Knowledge and understanding of:**   * the action strategy to achieve the goal   **Abilities:**   * to develop a strategy when performing research   **Skills:**   * to develop ideology of the life cycle of a scientific project |
| *Able to apply modern communication technologies, including in a foreign language (s), for academic and professional interaction* | **Knowledge and understanding of:**   * 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:**   * to deal with leading databases of scientific papers and patents; * to apply scientometric tools for the analysis of scientific communication networks   **Skills:**   * searching information from leading databases of scientific articles and patents in Russia and the world; - skills of searching, processing and analyzing information from the leading databases of scientific articles and patents of 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. |
| *Able to independently acquire, develop and apply mathematical, natural science, socio-economic and professional knowledge to solve non-standard problems, including in a new or unfamiliar environment and in an interdisciplinary context;* | **Knowledge and understanding of:**   * 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 formulation and formalization of tasks in the professional sphere * to analyze information independently and get informed conclusions   **Skills:**   * dealing with information systems of scientific databases and patent offices |
| **Knowledge and understanding of:**   * methods of solving non-standard tasks in professional activity * mathematical foundations of scientometrics   **Abilities:**   * to deal with Russian and foreign scientific and patent databases * to apply 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 |
| **Knowledge and understanding of:**   * specifics of registration of intellectual property in various countries of the world * sources and types of trends, including scientific activity   **Abilities:**   * search and information analysis in the databases of the world's leading patent offices * scientometric methods and analytical tools for independent analysis of scientific trends   **Skills:**   * to work with patent information resources * visualization and analysis of global scientific trends using scientometric systems |
| *Able to analyze professional information, highlight its main parts, structure, draw up and present it in the form of analytical reviews with sound conclusions and recommendations* | **Knowledge and understanding of:**   * principles of presentation of research results   **Abilities:**   * to structure the results of research in accordance with the principles of preparing research reports * to compile analytical reviews with sound conclusions   **Skills:**   * making the reports on research results in the form of an analytical review |
| **Knowledge and understanding of:**   * 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:**   * perform the results of research in accordance with the standards, norms and rules;   **Skills:**   * making the reports on the results of research. |

**14. Learning and Teaching Methods:**

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).

**15. Methods of Assessment/Final assessment information:**

Interim assessment: interview, final assessment – analytical report

**16. Reading List:**

1. Novikov A.M. Research Methodology / A.M. Novikov. – М. : Librokom, 2010. – 284 p. – URL: <http://biblioclub.ru/index.php?page=book&id=82773> (access date: 15.05.2020).
2. Kumar, R. Research methodology: a step-by-step guide for beginners. – 5th edition. – Sage Publications Ltd. – 2019. – URl: <http://www.sociology.kpi.ua/wp-content/uploads/2014/06/Ranjit_Kumar-Research_Methodology_A_Step-by-Step_G.pdf>.
3. Kusnetsov I. N. Fundamentals of scientific research: a textbook / I.N. Kuznetsov. – 3d ed. – М. : Publishing and Trading Corporation “Dashkov and Co.”, 2017. – 283 p. – URL: <http://biblioclub.ru/index.php?page=book&id=450759> (access date: 15.05.2020).
4. Kravchenko Yu.A. Trends in the development of computer technologies: a textbook / Yu.A. Kravchenko, E.V. Kuliev, D.V. Zaruba; Southern Federal University; Engineering and Technological Academy - Taganrog: Southern Federal University Press, 2017. – 107 p. <http://biblioclub.ru/index.php?page=book&id=493214> (access date: 15.05.2020).
5. Mokhnacheva Yu.V. Collection and interpretation of bibliometric data on WoS CC, SCOPUS and RSCI: methodological recommendations / Yu.V. Mokhnacheva; eds. V.A. Tsvetkova. – Moscow ; Berlin : Direct-Media, 2018. – 155 p. : ill., tbl. – URL: <https://biblioclub.ru/index.php?page=book&id=496061> (access date: 15.05.2020).

**Online resources**

1. Scientific Electronic Library eLIBRARY.RU (<https://elibrary.ru>) - the national bibliographic database of scientific citation, accumulating more than 12 million publications of Russian authors, as well as information on the citation of these publications from more than 6,000 Russian journals. The library is integrated with the Russian Science Citation Index (RSCI);
2. Scopus (<https://www.scopus.com>) – bibliographic and abstract database and a tool for tracking the citation of articles published in scientific publications; indexes scientific journals, conference proceedings, serial book publications and intellectual property results from five patent organizations (World Intellectual Property Organization, European Patent Office, US Patent Office, Japanese Patent Office, UK Intellectual Property Office);
3. Web of Science (<https://www.webofknowledge.com>) – an Internet search platform that combines abstract databases of publications in scientific journals and patents, including databases that take into account the mutual citation of publications. Web of Science covers materials on natural, technical, social, humanities, and the arts;
4. - Federal Institute of Industrial Property (https://www.fips.ru) – Russian patent database, the search engine of which includes a search for inventions in Russian and English, utility models, trademarks, well-known trademarks, names of origin of goods, industrial designs, computer programs, databases, integrated circuit topologies and classifiers;
5. Espacenet (<https://worldwide.espacenet.com>) – search engine for patent documents in more than 90 countries and international organizations (including Russian patent documents);
6. PatentScope (<https://patentscope.wipo.int>) – the World Intellectual Property Organization (WIPO) patent database, which searches 89 million patent documents, including 3.8 million published international patent applications;
7. SciVal ([http://scival.com](http://scival.com/)) – modular information and analytical system for monitoring and analyzing international scientific research;
8. Dimensions ([http://dimensions.ai](http://dimensions.ai/)) – scientometric search and analysis platform;
9. Overleaf, Online LaTeX Editor (<https://www.overleaf.com>) – online LaTeX editor with document collaboration function;
10. The Comprehensive TeX Archive Network (<https://ctan.org>) – archive of TeX materials: a catalog of packages with brief descriptions and detailed documentation, software, a catalog of TeX symbols, etc.;
11. - Catalog of state standards of the Russian Federation (<http://protect.gost.ru>) - catalog of standards on the website of the Federal Agency for Technical Regulation and Metrology (Rosstandart).