Національний технічний університет України
«КИЇВСЬКИЙ ПОЛІТЕХНІЧНИЙ ІНСТИТУТ
імені ІГОРЯ СІКОРСЬКОГО»

**Department of Telecommunications**

SCIENTIFIC AND INNOVATION ACTIVITIES ORGANISATION

# Work program of the discipline (Syllabus)

## Details of the discipline

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| level of high education | The third (educational and scientific) |
| **Field of knowledge** | *17* Electronics and Telecommunications |
| **Specialty** | *172* Telecommunications and Radio Engineering |
| **Educational program** | Telecommunications and Radio Engineering |
| **Discipline status** | Normative |
| **Form of study** | Eye (day) |
| **Year of preparation, semester** | *2nd year, autumn and spring semesters* |
| **The scope of discipline** | *4 credits - 120 hours* |
| **Semester control / control measures** | *Test* |
| **Lessons schedule** | *2 hours a week* |
| **Language of instruction** | *Ukrainian, English* |
| **Information about course leader / teachers** | Lecturer: Doctor of Technical Sciences, Professor Romanov Alexander Ivanovich, a_i_romanov@ukr.net<br>Practical / Seminar: Doctor of Technical Sciences, Professor Romanov Alexander Ivanovich, a_i_romanov@ukr.net |
| **Course placement** | Link to remote resource https://classroom.google.com/u/0/h (Google classroom) course code e3gpz46 |

## Curriculum

### 1. Description of the discipline, its purpose, subject of study and learning outcomes

The purpose of the discipline is to form graduate students' knowledge of the laws and methods of scientific and technical creativity, to form and develop practical skills and abilities in setting, organizing, planning and performing research in solving real scientific problems, as well as managing research work . In determining the content of the discipline was taken into account the general direction of training future professionals to work as developers and researchers in the field of infocommunications. The structure of the discipline includes topics that contain information about the methods of systematic analysis, planning and evaluation of research results used in the process of research and development. The discipline considers the issues of methodological bases of scientific research, principles of theoretical and experimental research, use of modeling methods in scientific research, the order of registration of research results in the form of scientific works, registration of research results in the form of abstracts, articles, dissertations.

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| **Objectives of the discipline** | ***Objects of study and activity***: processes of research, design, modernization, implementation and operation of modern telecommunications and radio engineering systems, complexes, technologies, devices and their components.<br>Formation of logical thinking in students, development of their intelligence and abilities;<br>In-depth training of graduate students on the techniques and methods of applying mathematical methods for solving applied scientific and technical problems of analysis of innovative areas of development in telecommunications and radio engineering. |

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| **The subject of the discipline** | Theoretical content includes: terms, categories, concepts, principles, standards, models and methods of building and functioning of telecommunication and radio engineering systems, complexes, technologies, devices and their components.<br>Methods, techniques, approaches and technologies: research, design, modernization, implementation and operation of modern and advanced telecommunication and radio engineering systems, complexes, technologies, devices and their components. |
| **General Competencies (GC)** | Ability to critically analyze, evaluate and synthesize new complex ideas (GC 1);<br>Ability of critical thinking and solving the problems of scientific and research of innovation spheres; widening the limits and reinterpretation of available theoretical knowledge and professional practice (GC 3);<br>Ability of interactive communication with the broader scientific community and the public in the field of scientific and/or professional activities. (GC 6);<br>Ability to search, process and analyze information from different sources (GC 9) |
| **General Competencies (GC)** | Ability to critically analyze, evaluate and synthesize new complex ideas (GC 1)<br>Ability to initiate, develop and implement research and innovation projects including own research (GC 2);<br>Ability of interactive communication with the broader scientific community and the public in the field of scientific and/or professional activities. (GC 6);<br>Ability to contribute to technological, social and cultural progress in academic and professional contexts. (GC 7);<br>Ability to adhere to the ethics of research, as well as the rules of academic integrity in research and scientific and pedagogical activities (GC 8)<br>Ability to search, process and analyze information from different sources (GC 9); |
| **Special professional competencies (SC)** | Ability to adapt and summarize the results of modern research for solving scientific and practical problems (SC 1)<br>Ability to apply mathematical methods of scientific research, simulation modeling, applied aspects of systems analysis in various kinds of professional (SC 2)<br>Ability to perform theoretical and experimental research, mathematical and computer modeling of processes in telecommunications and radio engineering systems and devices. (SC 3)<br>Ability to prepare educational proposals and implement the educational process for the Ukrainian and other home audiences, to refine teaching methods for a better understanding of the subject. (SC 7)<br>Ability to commit the research ethics as well as the rules of academic integrity in scientific research and scientific and pedagogical activities. (SC 8)<br>Ability to carry out scientific and pedagogical activities in higher education using new pedagogical approaches and practices, including information technology, multimedia tools in the educational process |

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| | for Ukrainian and other domestic audiences, improving teaching methods for a better understanding of the subject. (SC 9) |
| **Program results of teaching (PRT)** | KNOWLEDGE<br>Conceptual and methodological knowledge in the field of research and / or professional activity and between the subject fields (KN 1)<br>Modern methods and technologies of scientific communication in Ukrainian and foreign languages (KN 3)<br>Research methods of mathematical models and algorithms of data base control systems, distributed and web-based systems, integrated telecommunication networks, radio and video systems, information processing systems. (KN 5)<br>Peculiarities of philosophical and ideological conditions, modern tendencies, directions and regularities of development of Ukrainian science in the conditions of globalization and internationalization. (KN 6)<br>SKILLS<br>To use innovative approaches in solving problems and tasks, to show autonomy, scientific and professionalism (SK 1)<br>Reconsider existing and create new holistic knowledge and/or professional practice and solve significant social, scientific, cultural, ethical, and other problems. (SK 3)<br>To carry out research and innovation activities of scientific teams by initiating international scientific cooperation and academic mobility, and writing research papers, preparation of scientific reports, validation and implementation of the results of research and development, dissemination of information about the results of research at international conferences, seminars, etc. (SK 6)<br>Organize and manage the research, innovation and investment activities, business projects and production processes with regard to technological indicators, market requirements, existing standards, and the competitiveness of scientific and engineering products (SK 8)<br>Create a complete methodological and didactic support for the professional and basic training of teachers at all levels of higher education, adapt the material available in accordance with scientific and technological progress, the special features of teaching, the current norms and standards (SK 10)<br>To provide and analyze the choice of a specific type of model and method of telecommunication and radio engineering systems when solving relevant practical tasks (SK 11). |

## 2. Prerequisites and post requisites of the discipline (place in the structural and logical scheme of education according to the relevant educational program)

Successful mastering of this discipline is based on the list of knowledge of the following disciplines: Innovative directions of development of telecommunications and radio engineering, Mathematical methods of scientific research in telecommunications and radio engineering, Simulation modeling in telecommunications and radio engineering, Applied aspects of systems analysis in telecommunications and radio engineering

## 3. The content of the discipline

The discipline consists of two credit modules. Credit module 1 "Organization of scientific and innovative activities - 1" and credit module 2 "Organization of scientific and innovative activities - 2". Credit module 1 studies two topics: topic 1 "Fundamentals of scientific research" and topic 2 "Organization of work with scientific information". Credit module 2 studies one topic - "Theoretical and experimental research".

## 4. Training materials and resources

Basic literature:

1. Achievements in telecommunications 2019 / for science. ed. M.Yu. Ilchenko, S.O. Kravchuk: monograph. - Kyiv: Institute of Gifted Man NAPS of Ukraine, 2019.-336 p.

2. Zgurovsky MZ, Ilchenko M.Yu., Yakornov EA Organization of scientific research in the field of telecommunications. Textbook. - Kyiv: NTUU "KPI" named after Igor Sikorsky, 2018 - 336 p.

3. Romanov OI Organization of scientific and innovative activities. Lecture notes

Additional literature:

1. Yakornov EA Basics of the scientific research. Lecture notes., K .: ITS NTUU "KPI", 2015. 67 p.

2. Romanov OI Telecommunication networks and management. K, VPC "Kyiv University", 2003, 247p.

## Educational content

## 5. Methods of mastering the discipline (educational component)

The discipline consists of two credit modules.

Under credit module 1:

1. Lectures: Lecture 1. "Introductory lecture"; Lecture 2. "Methodological foundations of scientific research"; Lecture 3. "Levels and stages of scientific knowledge"; Lecture 4. "Methodology and methods of scientific research"; Lecture 5. "Methods of theoretical research"; Lecture 6. "Methodological methods of scientific research".

2. Practical classes: Practical lesson 1. " Basic tasks and components of science "; Practical lesson 2. "Methods and models of theoretical and empirical research"; Practical lesson 3. "Choosing the type of model of the object of study"; Practical lesson 4. "Registration of research results in the form of scientific work"; Practical lesson 5. "Methods of analysis of literature in the field of dissertation research"; Practical lesson 6. "Work on the article"; Practical lesson 7. "Working with representatives of magazines".

Under credit module 2:

1. Lectures: Lecture 1. "Planning of research work"; Lecture 2. "Organization of research work"; Lecture 3. "Elements of the theory and methodology of scientific and technical creativity"; Lecture 4. "Research work of students and graduate students"; Lecture 5. "Choosing a research topic"; Lecture 6. "Evaluation of the effectiveness of scientific research"; Lecture 7. "Analytical methods in theoretical research"; Lecture 8. "Probabilistic - statistical methods in theoretical research"; Lecture 9. "Methods of modeling physical processes".

2. Practical classes: Practical lesson 1 "Choosing a research topic"; Practical lesson.2 "Evaluation of the effectiveness of research"; Practical lesson 3 "Analytical methods of modeling"; Practical lesson 4 "Probabilistic - statistical methods of modeling in theoretical research"; Practical lesson 5 "Methods of modeling physical processes"; Practical lesson 6 "Method of estimating the capacity of telecommunications networks"; Practical lesson 7 "Method of calculating the channel capacity of the branches of the telecommunications network"; Practical lesson.8 "Algorithm for calculating the channel capacity of the branches of the telecommunications network"; Practical lesson 9 "Method of calculating the reliability of telecommunications networks".

## 6. Independent work of a student / graduate student

Student's independent work is an important element of studying the discipline. It is necessary that the knowledge gained during the study of the discipline is used in writing sections of the dissertation, in preparing reports on research results, writing articles, abstracts of reports at scientific conferences. Such work gives the chance to receive additional points at various types of certification. Students who have published articles in the leading publications of Ukraine, in the international scientometric database Scopus or Web of Science, after the report of the results of the practical lesson can get a test and grade "excellent" ahead of schedule.

## Policy and control

### 7. Discipline policy (educational component) and control

The following system of requirements is indicated to the student / graduate student:

- quality training and active work in all lectures and practical classes;

- preparation of abstracts and presentations for response to practical classes;

- preparation of materials for publication of articles on the topic of the dissertation;

- report substantiating the topic of dissertation research.

Quality control of students' knowledge of the materials of the discipline is carried out by questioning in practical classes, when performing MCR, as well as during the semester control. Assessment of students' success in the credit module is determined on the basis of the rating system.

### 8. Types of control and rating system for evaluation of learning outcomes (RSO)

The discipline consists of two credit modules. Credit module 1 "Organization of scientific and innovative activities - 1" and credit module 2 "Organization of scientific and innovative activities - 2".

1. The rating of a student from credit module 1 is calculated based on a 100-point scale, of which 60 points is the starting scale. The starting rating (during the semester) consists of points that the student receives for:

-performance of control works (6 express controls);

-preparation of a presentation and a report on a practical lesson (2 reports);

1.2 Criteria for scoring.

1.3. Express tests are evaluated with 10 points each:

- "excellent" - complete answer (at least 90% of the required information) - 9-10 points;

- "good" - a fairly complete answer (at least 75% of the required information) or a complete answer with minor errors - 7-8 points;

- "satisfactory" - incomplete answer (not less than 60% of the required information) and minor errors - 5-6 points;

- "unsatisfactory" - the answer does not meet the requirements for "satisfactory" - 0 points.

1.4. Presentation and report on the practical lesson is evaluated with 20 points:

- "excellent" - correctly and completely completed all tasks (at least 90% of the required information) - 19-20 points;

- "good" - partially completed tasks (not less than 75% of the required information) - 17-18 points;

- "satisfactory" - test tasks are performed with errors (not less than 60% of the required information) - 15-16 points;

- "unsatisfactory" - tasks are not completed or contain gross errors - 0 points.

2. The student's rating from credit module 2 is calculated based on a 100-point scale, of which 60 points is the starting scale. The starting rating (during the semester) consists of the points that the student receives for:

-performance of control works (6 express controls);

-preparation of a presentation and a report on a practical lesson (2 reports)

- performance of modular control work (MCR);

2.1 Criteria for scoring.

2.2 Express tests are evaluated with 5 points each:

- "excellent" - complete answer (at least 90% of the required information) - 5 points;

- "good" - a fairly complete answer (at least 75% of the required information) or a complete answer with minor errors - 4 points;

- "satisfactory" - incomplete answer (not less than 60% of the required information) and minor errors - 3 points;

- "unsatisfactory" - the answer does not meet the requirements for "satisfactory" - 0 points.

2.3 Modular test is evaluated with 30 points:

- "excellent" - correctly and completely completed all tasks (at least 90% of the required information) - 27-30 points;

- "good" - partially completed tasks (not less than 75% of the required information) - 22-26 points;

- "satisfactory" - the tasks of the test are performed with errors (not less than 60% of the required information) - 18-21 points;

- "unsatisfactory" - tasks are not completed or contain gross errors, MCR is not credited - 0 points.

2.4 Presentation and report on the practical lesson is evaluated with 20 points:

- "excellent" - correctly and completely completed all tasks (at least 90% of the required information) - 19-20 points;

- "good" - partially completed tasks (not less than 75% of the required information) - 17-18 points;

- "satisfactory" - test tasks are performed with errors (not less than 60% of the required information) - 15-16 points;

- "unsatisfactory" - tasks are not completed or contain gross errors - 0 points

3. Calendar intermediate attestation of students is carried out according to the value of the current rating of the student at the time of attestation. If the value of this rating is not less than 50% of the maximum possible at the time of certification, the student is considered certified. The condition for a positive first certification is to obtain at least 8 points. The condition for a positive second certification is to obtain at least 22 points.

4. The condition for admission to the test is a starting rating of at least 30 points.

5. On the test, students answer the question of the ticket. Each ticket contains four questions (tasks). Each question (task) is evaluated in 10 points according to the following criteria:

- "excellent", complete answer, not less than 90% of the required information (complete, error-free solution of the problem) - 9-10 points;

- "OK", a fairly complete answer, at least 75% of the required information, there are minor inaccuracies (complete problem solving with minor inaccuracies) - 7-8 points;

- "satisfactory", incomplete answer, not less than 60% of the required information, some errors (the task is performed with certain shortcomings) - 6 points;

- "unsatisfactory", the answer does not meet the conditions for "satisfactory" - 0 points.

7. The sum of starting points and points for the examination test is transferred to the overall score according to the table:

| *Scores* | *Rating* |
|---|---|
| 100-95 | Perfectly |
| 94-85 | Very well |
| 84-75 | Okay |
| 74-65 | Satisfactorily |
| 64-60 | Enough |
| Less 60 | Unsatisfactorily |
| Admission conditions are not met | Not allowed |

## 9. Additional information on the discipline (educational component)

- provisions on the rating system of performance evaluation are presented in the first lesson of the discipline;
- preliminary rating assessment of the credit module (discipline) is given to students in the last lesson;
- calendar attestation of students in the discipline is carried out by teachers according to the value of the current rating of the student at the time of attestation. If the value of this rating is not less than 50% of the maximum possible at the time of certification, the student is considered satisfactorily certified. Otherwise, in the attestation statement is set "not credited.

**Work program of the discipline (syllabus):**

Compiled by Professor of the Department of Telecommunications, Doctor of Technical Sciences, Professor Oleksandr Romanov

Approved by the Department of Telecommunications (Minutes № 9 of 25.05.2022)

Approved by the ITS Methodological Commission (Minutes № 4 of 02.06.2022)