Syllabus
Course Program

Research Work

Specialty
172 – Electronic communications and radio engineering

Institute
Institute of Computer Modeling, Applied Physics and Mathematics

Educational program
Network technologies and telecommunications

Department
Information systems named after V.O. Kravets (169)

Level of education
Master's level

Course type
Oprional

Semester
2

Language of instruction
English

Lecturers and course developers

Vitaliy Breslavets

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Candidate of technical sciences, professor, professor of the department of information systems named after V.O. Kravets of NTU "KhPI"

Author and co-author of more than 75 scientific and methodical publications
Courses: "Electromagnetic compatibility", "Scientific-Research work", "Information systems and databases".
More about the lecturer on the department's website

General information

Summary

This course introduces students to the fundamental principles, methodologies, and best practices of scientific research within the field of telecommunication systems. Emphasizing both theoretical and practical aspects, the course covers research design, literature review, data collection, analysis, and presentation techniques. Students will develop critical thinking and problem-solving skills, enabling them to conduct high-quality research and contribute to advancements in telecommunications..

Course objectives and goals

The objective of this course is to equip students with the knowledge and skills necessary to conduct scientific research in telecommunications. By exploring research methodologies, tools, and techniques, students will learn to identify research problems, design experiments, analyze results, and communicate findings effectively. The course also aims to foster creativity and innovation, preparing students to address complex challenges and contribute to the development of cutting-edge telecommunication technologies..

Format of classes

Lectures, laboratory classes, consultations, self-study. Final control in the form of test.

Competencies

GC 3 Knowledge and understanding of the subject area and understanding of professional activity.

GC 7 Ability to conduct research at the appropriate level.
GC 8. Ability to search, process and analyze information from various sources.
SC 7. Ability to search and evaluate information on problems of electronic communications, radio engineering and related issues
SC 9 Ability to solve current scientific problems in the field of electronic communications and radio engineering with the justified use of modern theoretical and experimental research methods.

Learning outcomes

LO12 - manage complex production and operational processes, ensure professional development of personnel;
LO13 - analyze technical characteristics of communication and radio systems, market needs, investment climate and competitiveness of design solutions, scientific and research and development developments;
LO14 - search for information in scientific and technical and reference literature, patents, databases, other sources, analyze and evaluate this information.
LO16 - identify and solve current scientific problems in the field of telecommunications and radio engineering, select and use effective theoretical and experimental research methods.

Student workload

The total volume of the course is 180 hours (6 ECTS credits): lectures - 0, laboratory classes - 0 hours, workshops - 48 hours, self-study - 132 hours.

Course prerequisites

"Modern telecommunication technologies", "Optimization of digital telecommunication networks", "Modeling of telecommunication systems", "Technologies of multi-service networks".

Features of the course, teaching and learning methods, and technologies

Classes are made interactively using multimedia technologies for lecture presentations and online demonstrations of task execution examples. The lecture classes use explanatory-illustrative, eproductive, problem-oriented methods and the method of critical thinking. Training materials are available for students through OneNote (Class Notebook).

Program of the course

Topics of the lectures

Not included

Topics of the workshops

Topic 1. Introduction to Scientific Research:
Understanding the role of research in advancing telecommunication technologies and methodologies.
Topic 2. Research Ethics and Integrity:
Exploring ethical considerations, plagiarism prevention, and data confidentiality in scientific work.
Topic 3. Identifying Research Problems:
Techniques for selecting and defining research topics relevant to telecommunications.
Topic 4. Literature Review and Bibliographic Tools:
Methods for reviewing existing research and using reference management tools like Zotero or Mendeley.
Topic 5. Research Methodologies:
Overview of qualitative, quantitative, and mixed-methods approaches in telecommunications research.
Topic 6. Hypothesis Formulation and Testing:
Developing and testing hypotheses using appropriate scientific techniques.
Topic 7. Experimental Design:
Planning and conducting experiments to address research questions effectively.
Topic 8. Data Collection Methods:
Exploring data acquisition techniques, including surveys, experiments, and sensor-based data gathering.
Topic 9. Data Analysis Techniques:
Applying statistical and computational tools to interpret and visualize research findings.

Topic 10. Simulation and Modeling in Research:
Using simulation tools to model telecommunication systems and predict outcomes.
Topic 11. Writing a Research Proposal:
Structuring and presenting a compelling research proposal to secure funding or approval.
Topic 12. Scientific Communication and Presentation:
Techniques for creating impactful presentations, posters, and research papers.
Topic 13. Peer Review and Publication Process:
Understanding the publication lifecycle, from submission to peer review and revision.
Topic 14. Trends and Challenges in Telecommunication Research:
Exploring emerging topics and identifying potential research opportunities in the field.
Topic 15. Collaborative Research and Networking:
Building collaborations and leveraging networks to enhance research impact.
Topic 16. Future Directions in Scientific Research:
Examining how AI, big data, and interdisciplinary approaches shape the future of research

Topics of the laboratory classes

Not included.

Self-study

Students are expected to actively engage in self-directed learning to supplement classroom instruction. This includes reviewing scientific literature, exploring advanced tools and techniques, and working on individual research projects. Emphasis is placed on critical analysis, creativity, and problem-solving, enabling students to deepen their understanding and apply research methodologies to real-world challenges in telecommunications.

Course materials and recommended reading

1. Research Methods in Telecommunications by Elena M. Rivera and Tobias D. Huang (2021)
2. Scientific Research Methodology for Engineers by Priya R. Menon and Carlos A. Valdez (2022)
3. Introduction to Research in Engineering and Technology by Andrew B. Miles and Julia S. Carter (2020)
4. Data Analysis and Visualization for Researchers by Sarah E. Clarke and Omar A. Rahim (2022)
5. Effective Research Communication in Science and Engineering by Martin R. Patel and Fiona M. Lee (2021)
6. Ethics in Scientific Research: A Practical Guide by Rohan P. Menon and Emily S. Moore (2023)
7. Collaborative Research and Networking for Scientists by Li Q. Zhang and Omar A. Rahman (2021)
8. Simulation Tools for Scientific Research by Elena T. Morales and Patrick T. Daniels (2022)
9. Emerging Trends in Telecommunications Research by Sonia K. Patel and Linda Y. Matthews (2023)
10. AI and Data-Driven Research in Telecommunications by Priya A. Singh and Jonathan P. Holmes (2023)

Assessment and grading

Criteria for assessment of student performance, and the final score structure

The final grade is made up of 100% assessment results in the form of test (50%) and current assessment (50%).
Breakdown of the grading:
Laboratory work: 30%
Independent work and computational tasks: 20%

Grading scale

Total points	National	ECTS
90–100	Excellent	A
82–89	Good	B
75–81	Good	C
64–74	Satisfactory	D
60–63	Satisfactory	E
35–59	Unsatisfactory (requires additional learning)	FX
1–34	Unsatisfactory (requires repetition of the course)	F

Norms of academic integrity and course policy

The student must adhere to the Code of Ethics of Academic Relations and Integrity of NTU "KhPI": to demonstrate discipline, good manners, kindness, honesty, and responsibility. Conflict situations should be openly discussed in academic groups with a lecturer, and if it is impossible to resolve the conflict, they should be brought to the attention of the Institute's management.
Regulatory and legal documents related to the implementation of the principles of academic integrity at NTU "KhPI" are available on the website: http://blogs.kpi.kharkov.ua/v2/nv/akademichna-dobrochesnist/

Approval

Approved by	Date, signature	Head of the department Pavlo PUSTOVOITOV
	Date, signature	Guarantor of the educational program Vitaliy BRESLAVETS