Syllabus
Course Program

Fundamentals Of Scientific Research

Specialty
141 –Electric power engineering, electrical engineering and electromechanics

Institute
Educational and Scientific Institute of Power Engineering, Electronics and Electromechanics

Educational program
Electromechanics

Department
Electrical Machines(126)

Level of education
Master's level

Course type
Mandatory

Semester
1

Language of instruction
English

Lecturers and course developers

Larysa Shylkova
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PhD, Specialty 141 –Electric power engineering, electrical engineering and electromechanics, docent of the Department of Electrical Machines

Author of more than 50 scientific and methodical publications.
Teaches disciplines: Energy-saving technologies in the production of electrical machines, Noise and vibration electrical machines, Prospects for development of electric power and electromechanics
More about the lecturer on the department's website

General information

Summary

The discipline is aimed at improving mastery apparatus of scientific research, studying and consolidating the methodology and methods of scientific research used at the general theoretical and practical levels, studying the factors affecting scientific research in the modern world.

Course objectives and goals

Formation of knowledge about fundamental and applied scientific research, regularities of the development of science, principles of innovation activities of masters in the specialty "Electrical machines".

Format of classes

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

Competencies

Ability to abstract thinking, analysis and synthesis.
Ability to search, process and analyze information from various sources.
Ability to use information and communication technologies.
Ability to apply knowledge in practical situations, work independently and in a team.

Ability to generate new ideas, make informed decisions, show creativity and system thinking, identify and assess risks.
Awareness of the need to constantly expand one's own knowledge about new technologies in electric power, electrical engineering and electromechanics.
The ability to apply analytical methods of analysis, mathematical modeling and perform physical, mathematical and computational experiments to solve engineering problems and when conducting scientific research.
The ability to apply information and communication technologies and programming skills to solve typical tasks of engineering and scientific activities in the power industry, electrical engineering and electromechanics.
The ability to use the acquired knowledge and skills to conduct scientific research of the appropriate level.
The ability to prepare and publish the results of one's research in specialized scientific publications.
The ability to adapt and act in a new situation, use effective strategies and tools to solve cognitive problems.

Learning outcomes

Analyze processes in electric power, electrotechnical and electromechanical equipment and corresponding complexes and systems.
Search for sources of resource support for additional training, scientific and innovative activities.
To present research materials at international scientific conferences and seminars devoted to modern problems in the field of electric power, electrical engineering and electromechanics.
Adhere to the principles and rules of academic integrity in educational and scientific activities.
To justify the choice of direction and methodology of scientific research taking into account modern problems in the field of electric power, electrical engineering and electromechanics.
Plan and implement scientific research and innovation and other projects in the field of electric power, electrical engineering and electromechanics.
To master new methods of synthesis of electric power, electrotechnical and electromechanical installations and systems with specified indicators.

Student workload

The total volume of the course is 120 hours (4 ECTS credits): lectures - 16 hours, practical classes - 32 hours, self-study - 72 hours.

Course prerequisites

The discipline is based on the bachelor's degree program

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

Lectures are conducted interactively using multimedia technologies. Take active forms of conducting: lecture, lecture-dialogue, lectures and training, practical classes, engineering seminar, conversation, consultation.
Practical activities emphasize a competent approach to learning, game methods, and an emphasis on the use of established information technologies in the organization of experimental and developmental research of electrical machines.

Program of the course

Topics of the lectures

Topic 1. Introduction. General concepts about science and scientific activity. Classification of sciences.
Topic 2. Technical sciences and their main aspects of scientific research. Management in the field of science.
Topic 3. Organization of research work. Stages of research work.
Topic 4. Tasks and methods of scientific research. Use of mathematical methods in research.

Topic 5. Analytical and probabilistic statistical research methods. Physical and mathematical simulations and modeling.
Topic 6. Scientific information: search, accumulation, processing. Experimental studies.
Topic 7. Computational experiment. Processing of experimental research results.
Topic 8. Scientific and practical results of scientific research. Presentation of research results.

Topics of the workshops

Topic 1. Scientific activity of participants in the educational process.
Topic 2. Levels of scientific training. Magistracy. Postgraduate studies. Doctoral studies. Specialties and specializations
Topic 3. Main aspects of scientific research in technical sciences.
Topic 4. Setting the stages of research work.
Topic 5. Planning of research work.
Topic 6. Organization of research work.
Topic 7. Setting tasks and choosing methods of scientific research.
Topic 8. Test of the first part of course.
Topic 9. Use of analytical and statistical research methods.
Topic 10. Use of physical and mathematical modeling in research.
Topic 11. Search, accumulation, processing of scientific information.
Topic 12. Processing experimental research.
Topic 13. Scientific and practical results of scientific research.
Topic 14. Presentation of research results in the form of a report.
Topic 15. Presentation of research results in the form of an articles.
Topic 16. Test of the second part of course.

Topics of the laboratory classes

The curriculum does not include laboratory classes.

Self-study

The discipline provides for the performance of the calculation task "Organization of scientific research". The calculation task contains a report on the execution of the calculation according to the selected option. Students are recommended additional materials (videos, articles) for independent study.

Course materials and recommended reading

1. C. George Thomas Research Methodology and Scientific Writing / 2nd Edition, Springer, (eBook) https://doi.org/10.1007/978-3-030-64865-7.
2. Hans-Kristian Ringkjøb, Peter M. Haugan, Ida Marie Solbrekke A review of modelling tools for energy and electricity systems with large shares of variable renewables / Renewable and Sustainable Energy Reviews, Volume 96, November 2018, Pages 440-459. https://doi.org/10.1016/j.rser.2018.08.002.
3. William S. Jewell New Methods in Mathematical Programming—Optimal Flow Through Networks with Gains / Operations Research, Vol. 10, No. 4, https://doi.org/10.1287/opre.10.4.476.
4. Petr LEZHNIUK , Vyacheslav KOMAR , Olena RUBANENKO , Natalia OSTRA The sensitivity of the process of optimal decisions making in electrical networks with renewable energy sources / PRZEGLĄD ELEKTROTECHNICZNY, ISSN 0033-2097, R. 96 NR 10/2020. doi:10.15199/48.2020.10.05.

Assessment and grading

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

100% of the final grade consists of the results of the final assessment (20%) and the current assessment (80%).
Assessment is done orally during the survey. The current evaluation consists of evaluations for control tests (2 for 30 points) and defense of the calculation task (20 points).

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	29.08.2024	Head of the department Andrii YEHOROV
	29.08.2024	Guarantor of the educational program Yevhen BAIDA