Syllabus
Course Program

Experimental studies of electrophysical processes

Specialty
141 Electric Power Engineering, Electrical Engineering and Electromechanics

Institute
Institute of Power Engineering, Electrical Engineering and Electromechanics

Educational program
Electrical engineering

Department
Engineering Electrophysics (135)

Level of education
Master's level.

Course type
Profile, Selective

Semester
1

Language of instruction
English, Ukrainian

Lecturers and course developers

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Candidate of Technical Sciences, Associate Professor of the Department of Engineering Electrophysics of KhPI National Technical University

Author and co-author of more than 20 scientific and methodical publications. Courses: "Introduction to the specialty", "Wind energy", "Fundamentals of electrophysical technologies", "Experimental studies of electrophysical processes", "Calculation and design of magnetic pulse installations".
More about the lecturer on the department's website

General information

Summary

As part of the course "Experimental studies of electrophysical processes", methods of experimental studies, rules for drawing up a plan for conducting an experiment, processing the obtained results, choosing experimental equipment and studying the principle of their operation, methods of protecting measuring equipment from guidance and interference, safety rules for working with experimental equipment are considered.

Course objectives and goals

Training of a specialist who knows the methods of experimental research, knows how to organize and draw up an experiment plan, process the obtained results, be able to choose experimental equipment and make measurements during the experiment, protect the measuring equipment from guidance and interference, knows the rules of safety when working with experimental equipment.

Format of classes

Lectures, practical classes, consultations. Individual calculation task. Final control - exam.

Competencies

ZK1. Ability to apply knowledge and understanding in practice in a manner that indicates a professional approach to electrical engineering problem solving.

ZK 7. Ability to make informed decisions.
ZK 9. The ability to produce new ideas, to show creativity, the ability to system thinking.
ZK 10. The ability to work independently and in a team, the ability to communicate with colleagues in the field regarding scientific developments and achievements.
FC 1. Ability to apply acquired theoretical knowledge, scientific and technical methods and appropriate software to solve scientific and technical problems and conduct scientific research in the field of electric power, electrical engineering and electromechanics.
FC 11. The ability to comply with the requirements of the rules of safety and occupational health and industrial sanitation when working at enterprises of electric power and electromechanical complexes.
FCs 20. Acquisition and use of professional knowledge and understanding related to the processes of operation of electrophysical high-voltage installations for scientific research and industrial technologies, as well as renewable energy installations.

Learning outcomes

PRN 2. Analyze processes in electric power, electrotechnical and electromechanical equipment and corresponding complexes and systems.
PRN 11. Choose the direction of scientific research and take part in it, taking into account modern problems in the field of electric power, electrical engineering and electromechanics.
PRN 23. Assess hazards when performing work in electrical installations
PRNs 22. To be able to effectively apply modern methods of determining the conditions and parameters of the functioning of non-traditional and renewable energy systems.
PRNs 23. To be able to use modern scientific knowledge and effectively apply it in the field of operation of high-voltage installations.
PRNs 40. To know and understand the work processes of electrophysical high-voltage installations for scientific research and industrial technologies, as well as installations of renewable energy.

Student workload

The total volume of the course is 150 hours (5 ECTS credits): lectures - 48 hours, practical classes – 16 hours, self-study - 86 hours.

Course prerequisites

In order to successfully complete the course, you must have knowledge and practical skills in the educational disciplines of the bachelor's level in the specialty 141 Electric Power Engineering, Electrical Engineering and Electromechanics

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

Lectures are conducted interactively using multimedia technologies. In practical classes, a project approach to learning is used, attention is focused on the application of information technologies. Study materials are available to students through Class Notebook and as a distance course in the Moodle system.

Program of the course

Topics of the lectures

Introduction. The purpose and objectives of the course. Recommended Books. Formation of experimental studies.
Topic 1. The role of scientific information in experimental research. Organization of scientific activity in the field of electrical engineering.
Sources and search of scientific information. Scientific team as a special structure in science. Basic principles of management of the scientific team.
Topic 2. Methodology of experimental research.
Classification of experiments. Methods of experimental research. General requirements for the experiment. Metrological support of experimental studies.
Topic 3. Processing of research results.

Experimental error. Analysis of random errors. distribution of the Student. Methods of graphic processing of measurement results. Analytical processing of the results of the experiment.
Topic 4. Publishing the results of the experiment.
Topic 5. Means of measuring magnetic field parameters.
Devices with magnetoresistive sensors. Devices with NMR-based sensors. Devices with SQUIDS. Devices with ferroprobe sensors. Devices with frequency converters. Devices with semiconductor sensors.
Topic 6. Means of measuring the parameters of elements of alternating current electric circuits.
Measurement of components of complex resistance. Measurement of mutual inductance. Measurement of the parameters of alternating current circuit elements by the resonance method. Bridge methods of measuring parameters R, L, C.
Topic 7. devices that measure non-electric quantities by electrical methods.
Types and principle of action of resistive converters. Inductive converters. Capacitive converters. Induction converters. Piezoelectric, transformer, magnetoelastic transducers. Electret converters. Thermoelectric, photoelectric converters.
Topic 8. Oscillographic measurement methods. Types of oscilloscopes and the principle of their operation.
Topic 9. Rules for safe operation of high-voltage laboratory equipment.
Requirements for test facilities. Rules for the safe operation of electrical equipment.

Topics of the workshops

Topic 1. Practical application of experimental research methods.
Topic 2. drawing up a plan-program of the experiment.
Topic 3. Solving problems for calculating measurement errors.
Topic 4. Study of the probability of the appearance of a section of current pulses in the discharge circuit of a capacitive accumulator with a controlled vacuum discharger.
Topic 5. Calculation of parameters of bridge measurement schemes.
Topic 6. Study of the structure and measurement of the discharge current by the Rohovsky belt.
Topic 7. Measurement of electrical parameters with a digital oscilloscope.

Topics of the laboratory classes

Laboratory work is not provided for in the curriculum.

Self-study

The course involves the performance of calculation and creative individual tasks. Students are also recommended additional materials (videos, articles) for independent study and analysis.

Course materials and recommended reading

1. Basics of methodology and organization of scientific research: teaching. a guide for students, cadets, graduate students and adjuncts / Ed. A. E. Konverskyi. - Kyiv: Center for Educational Literature, 2010. - 352 p.
2. Smyrnyi M.F. Fundamentals of scientific research: lecture notes for students of all forms of education in the specialty 141 - Electric power, electrical engineering and electromechanics / M.F. Smyrnyi; Kharkiv. national city university farm named after O. M. Beketova. – Kharkiv: XNUMX named after O. M. Beketova, 2018. – 111 p.
3. Krushelnytska O. V. Methodology and organization of scientific research: teaching. manual / O. V. Krushelnytska. - Kyiv: Condor, 2003. - 192 p.
4. Sheiko V. M. Organization and methodology of scientific research activity: textbook / V. M. Sheiko, N. M. Kushnarenko. - 6th ed., revised. And add. - Kyiv: Znannia, 2008. - 310 p.
5. Research methods and organization of experiments / Ed. Prof. K. V. Vlasov, ed. the second, processing. and additional - Kharkiv: Humanitarian Center, 2013. - 412 p.
6. Measurement of high voltages and large currents / Study guide for students of the specialty "Electricity, electrical engineering and electromechanics" specialization "Technology and electrophysics of high voltages" // Compilers: V. O. Brzhezytskyi, O. R. Protsenko, M. Yu. Laposha - K.: NTUU "KPI", 2016. - 133 p.
7. Lagutin V.S. Ozhogin V.I. Strong pulsed magnetic fields in a physical experiment, 1988. 192 p

8. Methods and means of measuring electrical and non-electrical quantities: a study guide / D.M. Nesterchuk, S.O. Kvitka, S.V. Galko. – Melitopol: Publishing and printing center "Lux", 2017. - 206 p.
9. 13. Kuharchuk V.V. Basics of metrology and electrical measurements: a textbook / [V.V. Kuharchuk, V.Yu. Kucheruk, Y.T. Volodarskyi, V.V. Hrabko] – Kherson: Oldi-plus, 2013. – 538 p.
10. Oscilloscopes and methods of measuring radio technical quantities: teaching. guide/ Yu.Ya. Bobalo, L.A. Nedostup, etc. - Lviv, 2014. 88 p.

Assessment and grading

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

100% of the final grade consists of assessment results in the form of an exam (50%) and current assessment (50%).
Exam: written assignment (2 questions from theories + problem solving) and an oral report.
Current assessment: 3 control tests (10% each) and an individual task (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 Sergey MOSTOVY
	Date, signature	Guarantor of the educational program Oleksandr LAZURENKO