



Syllabus Course Program



Introduction to Speciality. Introductory practical training

Specialty

141 – Electric Power Engineering, Electrical Engineering and Electromechanics

Institute

Institute of Education and Science in Power Engineering, Electronics and Electromechanics

Educational program

Electrical Power Engineering

Department

Electric Power Stations (130)

Level of education

Bachelor's level

Course type

Special (professional), Optional

Semester

1

Language of instruction

English, Ukrainian

Lecturers and course developers



Tyshchenko Anna

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PhD, Associate Professor, Associate Professor

Author of more than 50 scientific, educational, and methodological publications. Leading lecturer of the disciplines: "Introduction to Speciality. Introductory practical training", "Economic assessment of energy saving problems".

[More about the lecturer on the department's website](#)

General information

Summary

The "Introduction to Speciality. Introductory practical training" is a survey course that covers the basics of electrical power engineering and energy conservation. As part of this course, students gain an understanding of the principles of production, transmission, distribution and consumption of electricity, technical aspects of the operation of power plants, modern trends in energy development and energy conservation measures. The course also includes an overview of modern technologies in the field of alternative energy. The course helps students see the wide range of possible career paths in the energy field and learn essential skills. No special knowledge is required to take this course.

Course objectives and goals

Goal.

Adaptation of students to the conditions of university life, familiarization with the organization of the educational process and teaching methods in universities, specialty profile, prospects for future professional activity. Formation of students' professional knowledge about energy and basic knowledge in the specialty necessary for studying further disciplines. Developing skills in working with basic and additional literature and creating scientific reports, their analysis and synthesis.

Objectives.

To know:

- basics of specialty;
- features of the personnel training system for the electric power industry;
- technology of electricity generation at power plants of various types;

– general provisions for the generation, transmission, distribution and consumption of thermal and electrical energy;

– structure and elements of the energy system.

To be able to:

– read and explain the principles of technological schemes of power plants of various types;

– analyze the current state of energy in their country and other countries of the world;

– explain the operating modes of power plants in the integrated power system.

Format of classes

Lectures, workshops, consultations, self-study. Coursework. Final control – exam.

Competencies

C01. Ability to abstract thinking, analysis and synthesis.

C02. Ability to apply knowledge in practical situations.

C05. Ability to search, process and analyze information from various sources.

C07. Ability to work in a team.

C08. Ability to work autonomously.

C09. The ability to realize one's rights and responsibilities as a member of society, to be aware of the values of a civil (free democratic) society and the need for its sustainable development, the rule of law, the rights and freedoms of a person and a citizen in Ukraine.

C20. Awareness of the need to constantly expand one's own knowledge of new technologies in electric power, electrical engineering and electromechanics.

C24. Obtaining and using professional knowledge and understanding related to the organization and support of electricity production processes based on traditional and renewable energy sources in compliance with the specified technological parameters of energy facilities and the quality of electricity.

Learning outcomes

PR01. To know and understand the principles of operation of electrical systems and networks, power equipment of electrical stations and substations, protective grounding and lightning protection devices and be able to use them to solve practical problems in professional activities.

PR04. To know the principles of operation of bioenergy, wind energy, hydropower and solar power plants.

PR07. To carry out the analysis of processes in electric power, electrotechnical and electromechanical equipment, relevant complexes and systems.

PR10. To find the necessary information in scientific and technical literature, databases and other sources of information, evaluate its relevance and reliability.

PR13. To understand the importance of traditional and renewable energy for the successful economic development of the country.

PR14. To understand the principles of European democracy and respect for the rights of citizens, take them into account when making decisions.

PR18. To be able to learn independently, acquire new knowledge and improve skills in working with modern equipment, measuring equipment and application software.

PR23. To know and understand the principles of the organization of electricity production processes based on traditional and renewable energy sources with compliance with the specified technological parameters of energy facilities and the quality of electricity.

Student workload

The total volume of the course is 90 hours (3 ECTS credits): lectures - 16 hours, practical classes (workshops) - 32 hours, self-study - 42 hours.

Course prerequisites

No special knowledge is required for this course.

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

Lectures are conducted interactively using multimedia technologies. Practical tasks are performed using open-source software or on the Microsoft 365 platform. Learning materials are available to students through the OneNote Class Notebook.

Program of the course

Topics of the lectures

Content module 1. General concepts of the energy sector. Energy structure.

Topic 1. Higher professional education in Ukraine and abroad.

History, current state and prospects for the development of high professional education. Prospects for the development of modern science and technology. NTU "KhPI": history of creation, structure, developments.

Topic 2. General concepts of the energy sector.

Energy structure. The importance of energy for people's lives and scientific and technological progress.

Topic 3. Energy, types and sources of its production.

Energy resources and their world reserves. Renewable and non-renewable resources.

Content module 2. Energy generation technology.

Topic 4. Electricity generation technology at thermal power plants.

Simplified basic technological diagram of thermal power plant. The most powerful thermal power plants of Ukraine and the world.

Topic 5. Electricity generation technology at nuclear power plants.

Nuclear power plants of Ukraine and the world. Overview of different types of reactors. Problems of atomic energy.

Topic 6. Technology of electricity generation at hydroelectric power stations.

Dam and channel hydroelectric power stations. Hydro-accumulating power plants. The most powerful hydroelectric power stations in the world.

Topic 7. Renewable energy.

Solar power plants. Wind farm. Geothermal power plants.

Content module 3. Electric power systems.

Topic 8. Energy transmission and distribution.

Basic electrical equipment. Electric energy and its quality. Electric circuits.

Topic 9. Concept of electrical power systems.

Consumers of electrical energy. Operating modes of electrical equipment. Relay protection and automation. Power systems management.

Topic 10. Ecology and environmental protection.

The impact of operation of various types of power plants on the environment.

Topics of the workshops

Topic 1. Scientific and technical library of NTU "KhPI" in the educational process: structure, service system and rules of use.

Topic 2. Student work at a higher educational institution. Norms of student behavior and ethics. Safety techniques in the student's work.

Topic 3. Information resources in the field 14 "Electrical engineering": problem-oriented databases. Open access resources; the concept of sources to be referenced.

Topic 4. Scientometric databases. Citation index; copyrights to objects of the library fund and open access sources. Plagiarism; official websites of NTU "KhPI" as sources of information; website of the Department of electric power stations.

Topic 5. Characteristics of specialties and specializations of the department. Acquaintance with laboratory facilities of the department. Opportunities for students of NTU "KhPI" to realize their own educational, social and research needs.

Topic 6. Work with a graphic and text editor. Designing formulas, figures, tables.

Topic 7. Formatting the structure of the document: sections, subsections, appendices.

Topic 8. Preparation of abstracts, reports on practical and laboratory works, individual tasks according to the standard.

Topic 9. Traditional methods of generating electrical energy.

Topic 10. Gas turbine and combined cycle gas plants.

Topic 11. Alternative methods of generating electrical energy.

Topic 12. Basic electrical equipment. Electric energy and its quality.

Topic 13. Drawing of the main electrical elements of the schemes of power plants in graphic editors.

Topic 14. Designing of electronic presentations.

Topic 15. Reports of students on selected essay topics.

Topic 16. Reports of students on selected essay topics.

Topics of the laboratory classes

Self-study

Individual task – Report

Topic in the form of an essay of 15–20 pages and oral presentation.

Assignments of free choice from the provided list or upon approval of the lecturer.

The report is prepared and defended at workshops.

Essay topics

- Hydropower as a renewable energy source: current state and prospects.
- The history of the development of atomic energy: discoveries and prospects.
- Wind farm: principle of operation, classification and technological features.
- Trends in the development of wind energy: modern technologies and future prospects.
- Problems and prospects of the development of nuclear energy.
- Technological aspects of using marine energy for electricity generation.
- The principle of operation of geothermal power plants: technologies and engineering solutions.
- Thermal power plants: principle of operation, classification and technological features.
- Wind energy and prospects for its development.
- Hydroelectric power stations: principle of operation, classification and technological features.
- The principle of operation of solar power plants: overview and comparative analysis.
- Bioenergetics as a field of renewable energy.
- Renewable energy sources as alternative energy.
- Thermal power plants and their role in the system.
- Hydro-accumulating power plants: principles of operation, role in the power system and prospects for development.

Topics

Topic 1. Modern trends in the development of renewable energy sources in the power industry.

Topic 2. Problems and prospects of the development of nuclear energy in the world.

Topic 3. Energy efficiency and modern technologies at power plants.

Topic 4. Modern technologies of electricity production and transmission.

Topic 5. Trends in the development of wind energy: modern technologies and future prospects.

Topic 6. World experience of using offshore wind farms.

Course materials and recommended reading

Compulsory.

1. Mohamed E. El-Hawary. Introduction to Electrical Power Systems, USA: Wiley, 2008, - 394 p.

2. Valentina V. Shevchenko. Basics of electric power engineering. Beginning, Kharkiv: NTU “KhPI”, 2022, - 256 p.

3. Leonard L. Grigsby. The electric power engineering handbook. Electric power generation, transmission, and distribution, USA: Taylor & Francis Group, 2012, - 559 p.

4. Leonard L. Grigsby. The electric power engineering handbook. Power systems, USA: Taylor & Francis Group, 2012, - 768 p.

Additional.

1. Adam Dorr and Tony Seba. Rethinking Energy 2020-2030. 100% Solar, Wind, and Batteries is Just the Beginning - Access: <https://tonyseba.com/wp-content/uploads/2020/11/RethinkingEnergy2020-2030-LRR.pdf>
2. Mansour Al Qubeissi, Ahmad El-kharouf and Hakan Serhad Soyhan. Renewable Energy - Resources, Challenges and Applications, UK: IntechOpen, 2020. – 519 p.
3. Wadhwa C.L. Electrical Power system. – New Academic Science, 2012. – 956 p.

Assessment and grading

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

Final score consists of up to:
 30 points for module tests,
 10 points for workshops tasks,
 20 points for workshop presentation
 20 points for report, and
 20 points for final tests.

Oral report presentation during workshops are mandatory.

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
 Oleksandr LAZURENKO

Date, signature

Guarantor of the educational program
 Halyna OMELIANENKO