



## Syllabus Course Program



# Introduction to the specialty. Introductory practice

### 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

Bachelor's level.

### Course type

Profile, Mandatory

### Semester

1

### Language of instruction

English, Ukrainian

## Lecturers and course developers



### Liutenko Larisa Anatoliivna

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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", «History of the development of scientific schools of the department».

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

## General information

### Summary

The course "Introduction to the specialty. Introductory practice" examines the main types, characteristics and features of traditional and renewable energy sources, their development and the possibility of implementation in Ukraine. Energy startups and the method of their creation.

### Course objectives and goals

Mastering theoretical knowledge of traditional and renewable energy sources and practical skills in the field of creation and development of energy startups. Formation of understanding of physical processes and the principle of operation of power plants of traditional and renewable energy, energy storage devices and modern electrophysical equipment.

### Format of classes

Lectures, practical classes, consultations. An individual assignment. 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 5. Ability to search, process and analyze information from various sources that take into account relevant social, scientific or ethical issues.

FC 12. Ability to study and analyze scientific and technical information in the field of electric power, electrical engineering and electromechanics.

### **Learning outcomes**

PRN 1. Find the necessary information in the information space.

PRN 2. Discuss professional topics.

PRN 5. To combine personal and public interests.

PRN 16. Determine the principles of construction and normal functioning of elements of electric power, electrotechnical electromechanical complexes and systems.

### **Student workload**

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

### **Course prerequisites**

To successfully pass the course, you need to have knowledge and practical skills in general physics and chemistry within the basic secondary education program.

### **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.

## **Program of the course**

### **Topics of the lectures**

**Topic 1. Development of energy industry of Ukraine.**

**Topic 2. Earth's energy balance.**

Law of conservation of energy, basic definitions. Energy of the Earth. Energy balance scheme.

**Topic 3. Thermal energy.**

Physical laws in thermal energy. Use of steam in power generation. Thermal power plants.

**Topic 4. Hydropower.**

Physical properties of the liquid. Hydroelectric power plants and the principle of their operation. Energy parameters of HPP.

**Topic 5. Hydropower.**

Channel, crevasse, tidal and wave hydroelectric power stations.

**Topic 6. Biomass energy.**

General characteristics of biomass. Types of biomass and their characteristics.

**Topic 7. Use of thermal energy. Heat pumps.**

Types, design and principle of operation of heat pumps.

**Topic 8. Hydrogen energy.**

Properties of hydrogen. Production of hydrogen. Storage, transportation, use of hydrogen.

**Topic 9. Wind energy.**

Wind, main characteristics of wind, causes of formation. Main types and characteristics of wind generators.

**Topic 10. Solar energy.**

Use of solar energy. Solar power plants, collectors, ponds.

**Topic 11. Energy accumulation.**

Energy storage systems, their types and principle of action.

**Topic 12. Electrophysical technologies.**

Types of electrophysical technologies, characteristics and scope of application.

## Topics of the workshops

Topic 1. The current state of energy in Ukraine.

Topic 2. Preservation of the Earth's energy balance.

Topic 3. Heat engines and problems of environmental protection.

Topic 4. Ecological impact of hydropower on the environment.

Topic 5. Use of thermal energy of the ocean. Hydrothermal stations.

Topic 6. Alternative fuels from biomass.

Topic 7. Thermal potential of Ukraine and the world. Use of heat pumps in Ukraine.

Topic 8. Production of hydrogen using alternative energy sources.

Topic 9. Wind energy potential of Ukraine and the world. Environmental friendliness and negative factors of wind energy.

Topic 10. Solar energy potential of Ukraine and the world. Passive solar technologies.

Topic 11. Accumulating systems of Ukraine and the world.

Topic 12. Use of electrophysical technologies in Ukraine and the world.

Topic 13. Energy startups of Ukraine.

Topic 14. Search for ideas, preparation and setting of startup goals.

Topic 15. The Lean Canvas model for work on a startup.

Topic 16. Startup pitch decks for attracting investors.

## Topics of the laboratory classes

Laboratory classes within the discipline is not provided.

## Self-study

The course involves individual work in the form of an essay. Students are also recommended additional materials (videos, articles) for independent study and analysis.

## Course materials and recommended reading

### Basic literature

1. Kharkiv Polytechnic. At the turn of the millennium [Text] / L. L. Tovazhnyanskyi [etc.]; HDPU. - Kharkiv: Prapor, 2000. - 383 p.
2. Varlamov G.B., Lyubchik G.M., Malyarenko V.A. Thermal energy and ecology: Textbook. - Kh.: "SAGA Publishing House, 2008. -234 p.
3. Tytko R. Renewable energy sources, 2010. – 533 p.
4. Alternative energy: [learning. study guide higher education app.] / M.D. Melnychuk, V.O. Dubrovin, V.G. Myronenko, I.P. Hryhoriuk, V.M. Polishchuk, G.A. Golub, V.S. Targonya, S.V. Dragnev, I.V. Svystunova, S.M. the cook - K: "Agrar Media Group", 2012. - 244 p.
5. Mkhitaryan N.M. Energy of non-traditional and renewable sources. Experience and perspectives. - Kyiv: Naukova dumka, 1999. - 320 p.
6. Renewable energy sources / According to general ed. S.O. Curls - Kyiv: Institute of Renewable Energy of the National Academy of Sciences, 2020. - 392 p.
7. Non-traditional and renewable energy sources: study guide/M.S. Szeged, M.Y. Oliynyk, O.B. Dudurich.- Lviv: Publishing House of Lviv Polytechnic, 2019.- 204 p.
8. Twydell J., Weir A. Renewable energy sources. - M.: Higher School, 1990. - 392 p.
9. Ryshard Tytko, Volodymyr Kalinichenko. Renewable energy sources (Poland's experience for Ukraine). - Warsaw - Krakow - Poltava, 2012. - 650 p.
10. Electrical technologies: education. manual / I. V. Batsurovska. Mykolaiv: MNAU, 2021. – 258 p.
11. <https://energytransition.in.ua/>
12. Development of startup projects: Synopsis of lectures [Electronic resource]: training. manual / O. A. Gavrish, K. O. Boyarynova, K. O. Kopishinska; KPI named after Igor Sikorsky. – Electronic text data. – Kyiv: KPI named after Igor Sikorskyi, 2019. – 188 p.
13. Development of startup projects: practicum [Electronic resource]: training. manual / O. A. Gavrish, K. O. Boyarynova, K. O. Kopishinska; KPI named after Igor Sikorsky. – Electronic text data. – Kyiv: KPI named after Igor Sikorskyi, 2019. – 116 p.

## Additional literature

1. Solovey O.I. Non-traditional and renewable energy sources: education. manual, 2007. – 484 p.
2. Babenko G. O. Wind energy complex of Ukraine - achievements, problems, prospects / G. O. Babenko, V.M. Bohma, Yu.V. Zhabsky and others. - K.: Energy news. Special issue, August 2003 - 25 p.
3. Melniychuk M.M. Geographical parameters of geothermal energy extraction in Ukraine / M.M. Melniychuk, S.R. Boblyakh, A.D. Kalko // Kharkiv National Herald. University named after V.N. Karazin. – 2010. – No. 33. - pp. 138–143.
4. Combined energy systems based on non-traditional energy sources // Technical report Kyiv, 1998.
5. Shvidenko A.Y., Malyutyna A.O., Gishchuk R.M. Solar radiation in the atmosphere and on the Earth's surface: Study guide. – Chernivtsi: Ruta, 2003. – 39 p.
6. Oliynyk Y.B. Basics of ecology: a textbook, 2012. – 558 p.
7. Collection of problems and methodical instructions for calculation, graphic and control works from the course "Non-traditional sources of energy" /Incl. Bespalko S.A., Yovchenko A.V., 2009. – 30 p.

## 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 assessment in the form of an exam (40%), an ongoing assessment (35%) and a coursework assessment (25%).

Exam: written assignment (3 theory questions + problem solving) and oral presentation.

Current evaluation: 7 test papers (5% each).

### 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  
Halyna OMELYANENKO