



## Syllabus Course Program



# Wind Power Energy

### Specialty

141 Electric Power Engineering, Electrical Engineering and Electromechanics

### Educational program

Electrical engineering

### Level of education

Bachelor's level.

### Semester

8

### Institute

Institute of Power Engineering, Electrical Engineering and Electromechanics

### Department

Engineering Electrophysics (135)

### Course type

Professional, Mandatory

### Language of instruction

English, Ukrainian

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## 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 power 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

The course "Wind Power Energy" examines the state and prospects of the development of wind energy, the main theoretical provisions of the conversion of wind energy into other types of energy, the composition, principle of operation and aerodynamic characteristics of wind energy installations of various types.

### Course objectives and goals

Acquaintance of students with the state and prospects of the development of wind power in the world and in Ukraine, the principles of operation and types of wind power installations, the use of wind power installations in the national economy, the characteristics of wind power installations and wind power stations, and the acquisition of theoretical knowledge and practical skills of their calculation. After completing the discipline course, students will know: principles of operation and types of wind power plants, characteristics of wind power plants, features of electricity generation by wind power plants; to be able to: determine the power of a wind power plant for given calculation conditions, choose a generator type, choose a connection scheme to the power system or an individual consumer's power supply scheme.

### Format of classes

Lectures, practical classes, laboratory works, consultations. Individual 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.

FC 3. Ability to use basic knowledge of general physics, higher mathematics, theoretical foundations of electrical engineering and electrical engineering materials to solve practical problems in the field of electric power engineering, electrical engineering and electromechanics.

## Learning outcomes

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

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 120 hours (4 ECTS credits): lectures - 30 hours, practical classes – 10 hours, laboratory classes - 10 hours, self-study - 70 hours.

## Course prerequisites

To successfully complete the course, you must have knowledge and practical skills in the following disciplines: "Higher mathematics", "General physics", "Introduction to the specialty", "Theoretical foundations of electrical engineering", "Electric machines".

## 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.

## Program of the course

### Topics of the lectures

Introduction. The history of the development of wind energy.

Topic 1. Wind energy resources. Natural phenomena that lead to the occurrence of winds.

Topic 2. Wind as a physical phenomenon. Energy characteristics of the wind.

Topic 3. Parameters and calculation of wind turbines with a horizontal axis of rotation.

Topic 4. Parameters and calculation of a wind turbine with a vertical axis of rotation.

Topic 5. Calculation method of wind generator blades.

Topic 6. Development and production of wind generator blades.

Topic 7. Wind turbine supports. Types of supports. Calculation.

Topic 8. Structural elements of wind turbines.

Topic 9. Advantages and disadvantages of wind turbines. Environmental impact of wind turbines.

Topic 10. Wind power plants. Modes of operation of wind power plants.

Topic 11. Transmission of wind turbine power through power system networks. Reservation of capacity of wind turbines.

Topic 12. Wind energy of Ukraine and the world.

Topic 13. Prospects for the development of wind energy.

### Topics of the workshops

Topic 1. Calculation of energy parameters of the wind.

Topic 2. Calculation of wind turbines with a horizontal axis of rotation.

Topic 3. Calculation of wind turbines with a vertical axis of rotation.

Topic 4. Calculation of wind generator blades.

Topic 5. Calculation of supports for vertical and horizontal-axial wind turbines..

## Topics of the laboratory classes

Topic 1. Determining the characteristics of the wind in the area.

Topic 2. Study of the characteristics of wind turbines with a horizontal axis of rotation.

Topic 3. Study of the characteristics of wind turbines with a vertical axis of rotation.

Topic 4. The influence of the number and geometry of wind turbine blades on its efficiency.

Topic 5. Study of wind turbine operating modes.

## Self-study

The course involves individual calculation work. The results of calculations and drawings are drawn up in a written report.

Students are also recommended additional materials (videos, articles) for independent study and analysis.

## Course materials and recommended reading

1. Inexhaustible energy: Book. 2. Wind energy / V.S. Kryvtsov, A.M. Oleinikov, A.I. Yakovlev. - Textbook. - Kharkiv: National. aerospace Kharkiv University aviation institute", Sevastopol: Sevast. national technical University, 2004. - 519 p.

2. Fundamentals of wind energy: a textbook / H. Pivniak, F. Shkrabets, Neuberger, D. Tsyplenkov; Ministry of Education and Science of Ukraine, National mountain Univ. - D.: NSU, 2015. - 335 p.

3. Alternative sources of energy. Wind energy: Education. help./ S.V. Syrotyuk, V.M. Boyarchuk, V.P. Galchak. - Lviv: "Magnolia 2006", 2018. -182 p.

4. Wind energy [Electronic resource]: education. manual for students specialty 141 "Electroenergetics, electrical engineering, electromechanics" / V. M. Golovko; KPI named after Igor Sikorsky. – Electronic text data (1 file: 5.5 MB). – Kyiv: KPI named after Igor Sikorskyi, 2019. – 88 p.

5. M. A. Zatuchna. - Teaching course design manual. - Kharkiv: National. Aerospace University "Khark. aviation institute". 2001. - 78 p.

6. Denysenko G.I. Design and calculation of wind power plants: Training. manual / G.I. Denisenko, L.P. Fedosenko, G.A. Kozlovsky - K.: KPI Publishing House, 1986. - 64 p.

7. Yakovlev A.I., Zatuchna M.A. Calculation of wind turbines with a vertical axis of rotation: Study. course design manual. - H.: Nat. aerospace Khai University, 2002.

8. Muto H. Joint experimental studies of Darier and Savonius rotors in a wind tunnel / H. Muto, Y. Terashima, E. Outa. - Tokyo, 1983. - 11 p.

9. Yu.V. Dziadykevich Energy management. Textbook / Y.V. Dziadykevich, R.B. Gevko, M.V. Buryak, R.I. Rozum. – Ternopil: Textbooks and manuals. - 2014. - 336 p.

10. DSTU 3896:2007 Wind power installations and wind power stations. Terms and definitions. - K.: Derzhstandard of Ukraine, 2008. - 24 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 (40%), current assessment (60%).

Exam: written assignment (2 questions from theories + problem solving) and an oral report.

Current assessment: 2 test papers (15% each) and an individual task (30%).

### 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