

<b>Name of subject</b>	<b>Modern wind energy devices and systems (ECTS 4)</b>
<b>Subject/module code</b>	ZSHEQT2204
Science taught semester (s).	2 <sup>nd</sup> semester
Responsible teacher	Abdullaev Elnur Akhmatovich, PhD., Associate professor
Education language	Uzbek
Connection to the curriculum	Elective
Training hours (this including independent education)	<b>Total hours-120</b> <b>2<sup>nd</sup> semester</b> <b>Contact hours – 36</b> Lecture training hour – 18 Practical training hour – 18 <b>Independent education -84 hours</b>
ECTS	4
The purpose and tasks of subject / learning outcomes	<p><b>The purpose of teaching the subject is</b> The purpose of teaching science is to prepare the ground for students to be able to apply theoretical and practical knowledge of the process of installation, design and preparation for operation of energy devices based on modern wind energy sources. They also include the formation of knowledge, skills and qualifications in accordance with the professional profile on the main types, structure, scope of use of devices based on alternative and renewable energy sources and methods of selecting them in accordance with specific conditions.</p> <p><b>The objective of the course</b> “Modern wind energy devices and systems” The task of science is to know the history of the development of wind energy, to understand the law of nature of wind and the specific characteristics of using wind as a resource, to know the wind atlas, to assess the wind potential of regions and buildings, to know the methods, the classification and typical design of wind devices of different capacities, including the elements of structures and to know the characteristics of their application, to understand the methods of analyzing the aerodynamics of wind turbines, to know their operation and maintenance, to know their characteristics, to understand the methods of analyzing the economic efficiency of wind energy, the world and to have an understanding of the prospects of further development of wind energy in our country.</p> <p>Learning Outcomes:</p> <ol style="list-style-type: none"> <li>1. Familiarity with modern wind energy devices and systems;</li> <li>2. The role and socio-economic importance of modern wind energy devices and systems in society;</li> <li>3. To know the classification and typical design of wind turbines of different capacities, including the elements of structures and their application features;</li> <li>4. Study of modern wind energy devices and systems with the help of computer programs;</li> <li>5. To study the technical and economic indicators of modern wind energy devices and systems, their place in ecology and the principles of use;</li> <li>6. Improving the performance of modern wind energy devices and systems;</li> <li>7. Economic evaluation of the competitiveness of traditional and non-traditional methods of electricity production;</li> <li>8. To know and be able to use the existing main legal and regulatory documents in the field.</li> </ol>
Course content (topics)	<b>I. Main Theoretical Part (Lecture Sessions)</b> Topics:

1. History of wind energy development.
2. Wind energy assessment methods.
3. The state of wind potential of our country.
4. Features of the design and application of modern wind energy.
5. Information about modern anemometers.
6. Parts of modern wind power plants.
7. Learning the drawing of the tower. Determining the location of the foundation and section parts.
8. Installation of trench pits and cable channels for the foundation.
9. Placement of soil layers for lining.

## **II. Instructions and recommendations for organizing laboratory exercises.**

Laboratory work is not included in the curriculum

## **III. Practical training instructions and recommendations**

The instructor's preparation for a practical session begins with the study of initial documents (such as the curriculum, topic schedule, etc.) and concludes with the development of a detailed lesson plan. The instructor must have a clear understanding of the objectives and tasks of the practical session, as well as the amount of work each student is expected to perform. Methodological guidelines serve as the primary instructional document for instructors in preparing and conducting practical sessions. The purpose of the practical session is to facilitate the comprehension of theoretical material, the acquisition of practical skills, the ability to consciously apply knowledge in academic and professional activities, and the development of critical thinking and confidence in forming personal viewpoints.

### *Recommended Practical Topics:*

1. Analysis of characteristics of anemometers and roto anemometers.
2. Analysis of wind energy reserves.
3. Calculation of ideal and real efficiency coefficients of wind generators.
4. Analysis of wind speed characteristics.
5. Determining the parameters of wind energy devices.
6. Calculation of comparative norms.
7. Determination of technical and economic indicators of wind energy devices.
8. Calculation of the process of converting wind energy into electricity.

## **IV. Independent learning and practical exercises**

Independent learning competency helps students to develop self-improvement skills and increase the efficiency of their professional activities. Students perform independent tasks on their mobile devices under the guidance of a teacher, either in traditional or electronic form.

### *Recommended topics for practical exercises:*

1. Features of the design and application of modern wind energy.
2. Information about modern anemometers.
3. Parts of modern wind power plants.
4. Study the drawing of the tower. Determining the location of the foundation and section parts.
5. Installation of trench pits and cable channels for the foundation.
6. Placing soil layers for priming.
7. Analysis of characteristics of wind gauges and roto anemometers.
8. Analysis of wind energy reserves.
9. Calculation of ideal and real efficiency coefficients of wind generators.
10. Analysis of wind speed characteristics.
11. Determining the parameters of wind energy devices.

	<p>12. Calculation of comparative norms.</p> <p>13. Determination of technical and economic indicators of wind energy devices.</p> <p>14. Calculation of the process of converting wind energy into electricity.</p>
Exam form	Written
Teaching/learning and examination requirements	<p>Complete mastery of theoretical and methodological concepts and practical knowledge of the discipline, the ability to correctly reflect the results of analysis, independently reason about the processes being studied and carry out tasks in the current, intermediate forms of control and independent work, pass written work on the final control.</p> <p>When drawing up final exam questions, deviations from the content of the discipline program are not allowed. The bank of final exam questions for each discipline is discussed at the meeting and approved by the head of the department.</p> <p>No later than 1 week before the start of the final control, tickets signed by the head of the department, enclosed in an envelope, are sealed by the Dean's office and opened 5 minutes before the start of the exam in the presence of students. Final exam duration is 80 minutes. Answers to final exam questions are recorded in copybooks with the seal of the Dean's office. After completion of the final work, the work is immediately encrypted by a representative of the Dean's office, and the copybooks are handed over to the commission for verification. From the moment of completion of the final exam, a period of 72 hours is allotted for checking and posting the results on the electronic platform.</p> <p>The teacher who taught the students in this discipline is not involved in the process of conducting the exam and checking the students' answers.</p> <p>Student(s) who are dissatisfied with the final exam results may submit a written or oral appeal within 24 hours of the publication of the final exam results. Complaints submitted after 24 hours from the publication of the final exam results will not be accepted.</p>
Scope of assessment criteria and procedure	<p><b>CURRENT CONTROL</b></p> <p>Purpose: Determining and assessing the student's level of knowledge, practical skills, and competencies on course topics.</p> <p>Instructions: The student's activity in daily classes is assessed through the student's mastery of course topics, as well as constructively interpreting and analyzing the educational material, developing module-specific skills, acquiring practical skills (in terms of quality and the specified number) and competencies, solving problem situations aimed at applying professional practical skills, working in a team, preparing presentations, etc.</p> <p>Current control form: Activity in lessons Preparing educational materials Working with sources within the subject Using educational technologies Working in a team Preparing presentations Working with projects.</p> <p><b>MIDTERM CONTROL</b></p> <p>Purpose: Assessing the student's knowledge and practical skills and level of mastery of lecture material after completing the relevant section of the course.</p> <p>Form and procedure of intermediate control: Midterm examination is held during the semester during the training sessions after the completion of the relevant module of the curriculum of the subject. Midterm examination is held once in written form within the framework of this subject. Midterm examination questions cover all topics of the subject.</p> <p><b>INDEPENDENT LEARNING</b></p> <p>Purpose: Independent learning is aimed at fully covering the content</p>

of this course, expanding the theoretical knowledge acquired, and establishing independent learning activities for students.

Form and procedure of independent education: independent work assignments are completed in the form of an educational project, presentation, case study, problem solving, information search, digest, colloquium, essay, article, abstract, etc. Completed assignments for independent study are placed in the electronic system and checked based on the anti-plagiarism program and evaluated by the subject teacher.

In this case, the uniqueness of the completed assignment should not be less than 60%, otherwise the assignment will not be accepted for assessment. The number of independent work assignments, depending on the nature of the subject, should not be less than 3 for one subject (module). Independent work assignments account for 60% of the points allocated for current and intermediate control.

#### FINAL CONTROL

Purpose: The final examination is held at the end of the semester to determine the level of mastery of the student's theoretical knowledge and practical skills in the relevant subject. The final examination is held at a specified time according to the examination schedule created by the Registrar's Office on the electronic platform.

Requirements: The student must have passed the current control, intermediate control and independent learning assignments by the deadline for the final control type in the relevant subject. A student who has not passed the current control, intermediate control and independent learning assignments, as well as who has received a score in the range of "0-29.9" for these assignments and control types, is not included in the final control type. Also, a student who has missed 25 percent or more of the classroom hours allocated to a subject without a reason is excluded from this subject and is not included in the final control type and is considered not to have mastered the relevant credits in this subject. A student who has not passed or was not included in the final control type and has received a score in the range of "0-29.9" for this type of control is considered to be an academic debtor.

Final control form: The final examination in this subject will be conducted in written form. If the final examination is conducted in written form, the requirements for assessment must also be reflected.

Criteria for assessing student knowledge	5 grade	100 points		Assessment criteria
	5	90-100	Excellent	When a student is considered to be able to make independent conclusions and decisions, think creatively, observe independently, apply the knowledge he has gained in practice, understand, know, express, and narrate the essence of the subject, and have an idea about the subject.
	4	70-89,9	Good	When the student is considered to be able to observe independently, apply the knowledge he has gained in practice, understand, know, express, and narrate the essence of the subject, and has an idea about the subject.
	3	60-69,9	Satisfactory	When the student is found to be able to apply the knowledge he has gained in practice, understands, knows, can express, and narrate the essence of the subject, and has an idea about the subject.

	2	0-59,9	Unsatisfactory	When it is determined that the student has not mastered the science program, does not understand the essence of the subject, and does not have an idea about the science.	
Course assessment criteria and procedure	Assessment type	Total points allocated	Control (task) form	Distribution of points	Qualifying score
	Current assessment	30 points	System tasks	20 points (divided by the number of tasks)	18 points
			Student activity (in seminars, practical, laboratory classes)	10 points	
	Midterm assessment	20 points	Supervision: Written work	10 points	12 points
			System tasks	10 points (divided by the number of tasks)	
	Final assessment	50 points	Written assignment (5 questions)	50 points (10 points per question)	30 points
* Note: 60% of the points allocated for current and intermediate control are allocated to independent work assignments. Independent work assignments are evaluated as system assignments through the electronic platform.					
Recommended Literature	<p><b>Main literature:</b></p> <ol style="list-style-type: none"> <li>1. Law of the Republic of Uzbekistan "On the use of renewable energy sources" No. ORQ-539, adopted on May 21, 2019.</li> <li>2. The Solar Generation: Childhood and Adolescence of Terrestrial Photovoltaics. Philip R. Wolfe, 2018.</li> <li>3. Physics of Solar Energy and Energy Storage. C. Julian Chen, 2024.</li> <li>4. Advances in Solar Photovoltaic Energy Systems (2024). Almoataz Y. Abdelaziz, Mahmoud A. Mossa, Najib El Ouanjli.</li> <li>5. Renewable Energy Sources: Engineering, Technology, Innovation: ICORES 2017 (Springer Proceedings in Energy)</li> <li>6. Wind and Solar Energy Systems: Design, Analysis, and Operation Authors: Kumari Namrata, R. P. Saini, D. P. Kothari</li> </ol> <p><b>Additional literature:</b></p> <ol style="list-style-type: none"> <li>7. Mirziyoyev Sh.M. Yangi O'zbekistonda erkin va farovon yashaylik. –T.: "TASVIR nashriyot uyi", – 2021.– 50 b.</li> <li>8. Mirziyoyev Sh.M. Milliy taraqqiyot yo'limizni qati'yat bilan davom ettirib yangi bosqichga ko'taramiz .–T.: "O'zbekiston", 2017– 592 b</li> <li>9. Decree of the President of the Republic of Uzbekistan dated January 28, 2022 No. PF-60 "On the Development Strategy of New Uzbekistan for 2022-2026".</li> <li>10. Decree of the President of the Republic of Uzbekistan No. PF-220 dated 09.09.2022 "On additional measures for the introduction of energy-saving technologies and the development of small-capacity renewable energy sources".</li> </ol> <p><b>Internet sites:</b></p> <ol style="list-style-type: none"> <li>11. <a href="http://www.gov.uz">www.gov.uz</a> –Government portal of the Republic of Uzbekistan.</li> <li>12. <a href="http://www.catback.ru">www.catback.ru</a> – international scientific articles and</li> </ol>				

	<p>educational materials website.</p> <p>13. <a href="http://www.google.ru">www.google.ru</a> – international educational materials search website.</p> <p>14. <a href="http://www.ziyonet.uz">www.ziyonet.uz</a> – national educational materials search website.</p> <p>15. <a href="http://www.lex.uz">www.lex.uz</a> – national database of legal documents and information.</p> <p>16. <a href="http://www.catback.ru">www.catback.ru</a> – scientific articles and educational materials.</p>
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