Subject name	**Reliability and safety of the power supply system (ECTS 6)**
Subject/module code	ELXI1706
Science taught semester (s).	7th semester
Responsible teacher	Jalilov Urinboy Abdunaim ugli, assistant.
Education language	Uzbek
Connection to the curriculum	Compulsory
Training hours (this including independent education)	**Total hours - 180** **Contact hours - 72** Lecture training hour - 36 Laboratory training hour - 24 Practical training hour - 12 **Independent education - 108 hours**
ECTS	6
The purpose and tasks of subject / learning outcomes	**The goal of teaching the subject** is to develop theoretical and practical knowledge in students about the reliability of electronic devices in the energy sector.. **The task of the subject** is to study the current state of the energy system, to familiarize with the specific features of the main enterprises and organizations that are part of the country's energy system, to teach various methods of generating electricity. In addition, to provide theoretical knowledge and develop practical skills in the transmission, distribution and use of electricity. **Learning outcomes:** 1. Studies the issues of reliability in the energy and power supply system, the development, history and prospects of the power system 2. The role and socio-economic significance of reliability in the energy and power supply system. 3. State policy in the energy sector and its development trends and prospects in the country and the world 4. Basic concepts in the power sector. 5. Key performance indicators for various types of transport and opportunities for their improvement 6. Increasing the efficiency of electricity generation equipment 7. Economic assessment of the competitiveness of traditional and unconventional methods of electricity generation 8. Knowledge of the main existing legal and regulatory documents in the field and their use
Course content (topics)	**I. Main theoretical part (Lecture)** **Topic 1:** Definitions of reliability theory in power supply systems and its basic concepts **Topic 2:** Concept, classification, flows and their characteristics of failures in power supply systems. **Topic 3:** Reliability indicators in power supply systems**.** **Topic 4:** Causes of failures of the main elements of the power supply system. **Topic 5:** Mathematical statistics and reliability calculations in power engineering **Topic 6:** Methods for calculating the reliability of complex circuits in power supply systems**.** **Topic 7:** Analysis of the consequences of failure of power equipment in power supply systems**.** **Topic 8:** Feasibility analysis of reliability in power supply systems**.** **Topic 9:** Average probability of failure of elements of the power

supply system by reliability indicators

II. Instructions and recommendations for organizing laboratory exercises.

In laboratory exercises, students develop practical skills and competencies in calculating and drawing tables and graphs, conducting experiments, and analyzing various indicators of processes in electrical networks and systems. The proposed topics are selected based on opportunities and conditions.

Recommended topics for laboratory work:

1. Application of the Binomial Distribution (Bernoulli) formula in reliability analysis and solving related problems;
2. Methods for calculating the reliability of a power supply system and solving related problems.
3. Probability theory in energy and solving related problems.
4. Probability laws of complex events and solving related problems
5. Reliability of circuits with elements connected in series and solving related problems
6. Reliability of circuits with elements connected in parallel and solving related problems

III. Instructions and recommendations for practical training

The teacher's preparation for a practical training begins with the study of the initial documents (curriculum, thematic plan, etc.) and ends with the development of a lesson plan. The teacher should have an idea of the goals and objectives of the practical training, the amount of work that each student must perform.

Methodological instructions are the main methodological document of the teacher in preparing and conducting practical training.

The purpose of a practical training is to understand the theory, acquire skills. It is to consciously apply it in educational and professional activities, and to develop the ability to confidently form one's own point of view.

Recommended practical topics:

1. Reliability of the power supply system.
2. Reliability issues in the energy and power supply system.
3. Reliability characteristics of the power supply system
4. Failure currents of the elements of the power supply system and their characteristics.
5. Complex reliability indicators in the power supply system.
6. Causes of failure of the main elements of the power supply system.

IV. Independent learning and independent work.

Independent learning competence serves to support students' independent self-development and increase the effectiveness of professional activities. Students perform independent work on their mobile devices under the guidance of a teacher in a traditional or electronic form.

Independent study of the recommended topics:

1. Basic concepts and characteristics of reliability in the power supply system
2. Reliability characteristics of the power supply system
3. The concept of failure in the power supply system.
4. Failure currents of the elements of the power supply system and their characteristics.
5. Unified indicators of reliability in the power supply system.
6. Calculation of the conditions of power networks.
7. Simple and complex substances and their significance.
8. Power and energy losses in power networks.

	9. Random quantities of reliability and their distribution laws. 10. Basic concepts of mathematical statistics and reliability calculations in power engineering. 11. Modeling the operating conditions of power networks using computer programs, developing practical skills.
Exam form	Written
Teaching/learning and examination requirements	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. 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. 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. The teacher who taught the students in this discipline is not involved in the process of conducting the exam and checking the students' answers. 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.
Scope of assessment criteria and procedure	CURRENT CONTROL Purpose: Determining and assessing the student's level of knowledge, practical skills, and competencies on course topics. 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. 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. MIDTERM CONTROL Purpose: Assessing the student's knowledge and practical skills and level of mastery of lecture material after completing the relevant section of the course. 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. INDEPENDENT LEARNING

Purpose: Independent learning is aimed at fully covering the content 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

Main literature:

1. A.J.Nimatullayev, A.I.Usmonov. Elektr qurilmalarni ekspluatatsiya qilishda xavfsizlik texnikasi qoidalari // «O`zdavenergonazorat» elektr energetikada nazorat bo`yicha davlat inspeksiyasi. -T.: Nihol, 2016. – 288 b. ISBN 978-9943-23-090-3.

2.Karimov R.Ch., Rafiqova G.R., E.G.Usmonov, M.R.Ro'zinazarov. Yo'nalishga kirish. Ma'ruzalar matni,-T.: ToshDTU nashriyoti,2018.26-bet

3. A.J.Nimatullayev, A.I.Usmonov. Elektr qurilmalarni ekspluatatsiya qilishda xavfsizlik texnikasi qoidalari // «O`zdavenergonazorat» elektr energetikada nazorat bo`yicha davlat inspeksiyasi. -T.: Nihol, 2016. – 288 b. ISBN 978-9943-23-090-3.

4. Syahputra, R., Soesanti, I. (2015). "Control ofSynchronous Generator in Wind Power SystemsUsing Neuro-Fuzzy Approach", Proceeding ofInternational Conference on Vocational Education and Electrical Engineering (ICVEE) 2015, UNESA Surabaya, pp. 187-193.

5. Syahputra, R., (2016), "Transmisi dan Distribusi Tenaga Listrik", LP3M UMY, Yogyakarta, 2016.

6. Jamal, A., Syahputra, R. (2016). Heat Exchanger Control Based on Artificial Intelligence Approach. International Journal of Applied Engineering Research (IJAER), 11(16), pp. 9063-9069.

Additional literature:

7. Mirziyoyev Sh.M. Yangi O'zbekistonda erkin va farovon yashaylik. –T.: "TASVIR nashriyot uyi", – 2021.– 50 b.

8. O'zbekiston Respublikasi Prezidentining "Energiya tejovchi texnologiyalarni joriy qilish va kichik quvvatli qayta tiklanuvchi energiya manbalarini rivojlantirish bo'yicha qo'shimcha chora-tadbirlar to'g'risida"gi 09.09.2022 yildagi PF-220-son farmoni.

	Internet sources: 9. www.ziyonet.uz – milliy o‘quv materiallarini qidiruv sayti. 10. www.gov.uz – O‘zbekiston Respublikasining hukumat portali.