Name of subject	Power supply systemssystems(ECTS 6)
Subject/module code	ETT2406
Science taught semester (s).	4th semester
Responsible teacher	Jumanov Abbas Nabijanovich, assistant
Education language	Uzbek
Connection to the curriculum	Elective
Training hours (this including independent education)	**Total hours-180.** **Audience Training hours - 72.** Lecture training hour – 24 Laboratory training hour – 24 Practical training hour – 24 **Independent education -108 hours**
ECTS	6
The purpose and tasks of subject / learning outcomes	**The purpose of teaching the subject** is to teach students the parameters and conditions of power supplies, master the methods of calculating and analyzing the conditions of power supplies and systems, teach the basics of designing the development of power systems, teach measures to increase the economy of power supply, and familiarize themselves with the structural and mechanical parts of overhead power lines and teach the basics of their calculation **The task of the subject** is to teach students how to build switching schemes for Power supply system's elements and determine their parameters, calculate electrical conditions of open and closed power supplies of varying complexity, characteristic operating conditions of power supplies and their assessment, control and adjustment of power supplies; design power supplies, and the main criteria for improving and ensuring the efficiency of power supplies. **Learning outcomes:** 1.Study the history and prospects of the development of the Power supply systemssystem. 2.Get acquainted with the role and socio-economic significance of Power supply systemsin society. 3.Study the state policy in the energy sector and its development trends and prospects in the country and the world. 4.Study the basic concepts and principles of the Power supply systemssector. 5.Economic assessment of the competitiveness of traditional and unconventional methods of Power supply systemsenergy production. 6.Get a complete picture of Power supply systemsequipment and devices. 7.Gain knowledge and skills in the design of power supplies.
Course content (topics)	**I. Main Theoretical Part (Lecture Sessions)** **Topic 1:** Introduction. History of development of energy in Uzbekistan, current state and prospects Concept of electricity supply. Subject and methods of the science of "Electricity supply". History of development of energy in Uzbekistan. Analysis of the current state of energy and future energy. **Topic 2:**Energy production, transmission and distribution system Structure of electrical systems and articulation in production, transmission and distribution systems. Description of the main energy generating stations. **Topic 3:** Principles of operation of transformers. Electrical load graphs. Individual and group load graphs. Annual load graphs by duration. Seasonal electrical load graphs.. Basic quantities characterizing electrical load graphs. Coefficients characterizing electrical load graphs.

	Demand, form, filling, utilization, maximum, graph filling coefficients. Basic quantities characterizing electrical load graphs. Average, nominal, root mean square, maximum loads **Topic 4:** Notes on the electricity market in the management of the electricity generation system. Components of the electricity system Power lines (lines with bare conductors and cable lines, thermal behavior of cables, power determination, behavior of cables under overload conditions and under fault conditions) **Topic 5:**Schemes of Power supply systemsnetworks with voltage up to 1000 V.Characteristics of schemes used in Power supply systemsnetworks. Radial schemes. Trunk schemes. Mixed schemes. Lighting schemes. Working and emergency lighting. Types of trunk schemes. **Topic 6:**Issues of reactive power compensation in the Power supply systemssystem of industrial enterprises The concept of reactive power. General issues of reactive power compensation. Methods of reactive power compensation. Natural and artificial methods. Reactive power factor.. **Topic 7:**Cartogram of electrical loads and determination of the conditional center of loads. Concept of cartogram. Cartogram of electrical loads. Lighting sector. Main reducing substation. Conditional center of electrical loads. Conditions for installing a main reducing substation. **Topic 8**.Transformers. Selection of the number and capacity of power transformers in substations. Principles of operation of transformers. Conditions for parallel operation of transformers. Basic and additional protection of transformers Transformers and their types. Selection of the number of transformers in substations. Selection of the number of transformers in normal and emergency modes. Load factor. Transformer overload mode. Selection of transformer capacity in substations. **Topic 9:**Switching and protection devices (classification of direct and alternating current, interruption process, switches, disconnectors, load switches and load disconnectors, contactors, fuses). Relay. Automatic switches. Analysis of failure modes of electrical systems. Faults in electrical systems. Selection and sizing of protection systems for cable lines. Criteria for protection against overload and short-circuit overcurrents. **Topic 10:**Power supply systemsschemes, selection of cross-sectional areas of conductive parts and protective devices Power supply systemsschemes of industrial enterprises. External and internal schemes. Description of industrial enterprises by power. Requirements for schemes used in industrial enterprises. External and internal schemes. Deep-penetration substations.. Exchange scheme and its parameters. **Topic 11:**Selection of cross-sectional areas of overhead and cable lines Condition of prolonged heating from the influence of rated current. Condition of economic current density. Voltage of low-voltage cable lines.. **Topic 12:**Selection of electrical appliances. Electrical appliances and their description. Conditions for selecting electrical appliances. Extended study of the abbreviations of electrical appliances **II. Instructions and recommendations for organizing laboratory exercises.** During laboratory work, students will develop practical skills in Power supply systemsschemes, loads, reactive power compensation, and

quality indicators of electrical energy in industrial enterprises.

The following topics are recommended for laboratory work.

Recommended topics for laboratory work:

1.The exam consists of a 4-hour test using the Matlab program in a computer laboratory.

2.During the tests conducted at the LAIB, the use of calculators is not allowed due to the presence of computing devices in the laboratory. Oral exam (4 hours)

3.Study of circuit diagrams of shop networks with voltage up to 1000 V.

4.Study of the selection of devices for internal and external Power supply systemssystems

5.Power supply systemsschemes of industrial enterprises. Study of internal and external circuits

6.Study of the selection of the number and power of transformers

7.Study of the asymmetry and non-sinusoidality of current and voltage waveforms.

8.Study of the grouping of electrical energy consumers of industrial enterprises.

Laboratory work should be carried out by one teacher in a laboratory auditorium equipped with devices representing the topic of the work, with the number of students per academic group up to 15

III. Practical training instructions and recommendations

The teacher's preparation for a practical training session begins with the study of preliminary 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 session, the amount of work that each student must perform.

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

The purpose of the practical training session 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.

The following topics are recommended for practical training:

1.Calculation of the quantities characterizing the electrical load graphs

2.Overhead networks and electrical insulation materials

3.Calculation of the schemes of shop networks with voltages up to 1000 V.

4.Transformer supply and distribution devices.

5.Construction of a cartogram of electrical loads and determination of the installation location of the BPP.

6.Calculation of the cross-sectional areas of overhead and cable lines.

7.The effect of electric current on the human body. Underground systems. Protection against direct contact. Protection against indirect contact. Zero-category systems.

8.Assembly of automatic switching on of the reserve source (AVR) schemes.

9.Selection and testing of devices for internal and external Power supply systemssystems

10.Study of schemes of step-down substations of industrial enterprises

11.Power supply systemsschemes of industrial enterprises. Internal and external circuits.

12. Selection and sizing of protection systems for cable lines.

IV. Independent learning and independent work.

Students are encouraged to prepare and present abstracts on topics that are being studied independently. Independent work includes working with lecture notes and recommended literature, as well as

	periodicals and Internet materials, preparing for laboratory work, writing abstracts, and independent work using standard student and computer techniques. **Recommended topics for independent study:** 1.Grouping of electrical energy consumers of industrial enterprises. 2.Electrical load graphs of industrial enterprises and consumers. 3.Main quantities characterizing electrical load graphs. 4.Design load in the Power supply systemssystem and methods for its determination. 5.Determination of design load using the method of regulated diagrams. 6. Schemes of shop networks with voltage up to 1000 V. 7.Issues of reactive power compensation in the Power supply systemssystem of industrial enterprises. 8.Cartogram of electrical loads and determination of the conditional center of loads. 9.Transformers. Selection of the number and power of transformers. 10.Quality indicators of electrical energy. 11.Asymmetry and non-sinusoidality of current and voltage waveforms. 12.Power supply systemsschemes of industrial enterprises. Internal and external schemes. 13.Selection of devices for internal and external Power supply systemssystems. It is recommended that students prepare and present abstracts on topics that are independently mastered.
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	5	100		Assessment criteria

student knowledge

grade	points		
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.Steven W.Blume. Electric Power System Basics. USA.: Wiley – Intersciense A John Wiley Sous, INC Publication, 2007, 260 p.

2.Липкин Б.Ю., "Электроснабжение промышленных предприятий и установок", Учебник. -М.: "Высшая школа", 1980.

3.Кудрин Б.И., Електроснабжения промышленных предприятий. Учебник. -М.: Интермет Инжиниринг, 2005.

4.Qodirov T.M., Alimov H.A., «Sanoat korxonalarining elektr ta’minoti», O‘quv qo‘llanma, ToshDTU. -T.: 2006.

5.Qodirov T.M., Alimov X.A., Rafiqova G.R., Sanoat korxonalari va

fuqaro binolarining elektr ta’minoti. O‘quv qo‘llanma. ToshDTU, -T.: 2007.

6.Taslimov A.D., Rasulov A.N., Usmonov E.G., Elektr ta’minoti. O‘quv qo‘llanma. Ilm-ziyo. -T.: 2012.

7.A.N.Rasulov, A.D.Taslimov, I.U.Raxmonov, M.V.Meliqo‘ziev. Sanoat korxonalarining elektr ta’minoti. Darslik. 320 bet. T.:201.

Additional literature:

8.Mirziyoev SH.M. Erkin va farovon, demokratik O‘zbekiston davlatini birgalikda barpo etamiz. O‘zbekiston Respublikasi Prezidentining lavozimiga kirishish tantanali marosimiga bag‘ishlangan Oliy Majlis palatalarining qo‘shma majlisidagi nutqi. –T.: “O‘zbekiston” NMIU, 2016. – 56 b.

9.Mirziyoev SH.M. Qonun ustuvorligi va inson manfaatlarini ta’minlash – yurt taraqqiyoti va xalq farovonligining garovi. O‘zbekiston Respublikasi Konstitutsiyasi qabul qilinganining 24 yilligiga bag‘ishlangan tantanali marosimdagi ma’ruza 2016 yil 7 dekabr. – T.: “O‘zbekiston” NMIU, 2016– 48 b.

10.Mirziyoev SH.M. Buyuk kelajagimizni mard va olijanob xalqimiz bilan birga quramiz. - T.: “O‘zbekiston” NMIU, 2017. – 488 b.

11.O‘zbekiston Respublkasini yanada rivojlantirish bo‘yicha Harakatlar strategiyasi to‘g‘risida. - T.:2017 yil 7 fevral, PF-4947-sonli Farmoni.

12.Конюхова Е.А., Електроснабжение объектов: Учебное пособие. -М.: Издателство «Мастерство»; Высшая школа, 2001.

13.Ополева Г.Н., Схемы и подстансии електроснабжения: Справочник: Учебное пособие. - М.: ФОРУМ: ИНФРА-М, 2006.

14.Гулямов Б.Х., Салиев А.Г., Ташпулатов Б.Т., Тешабаев Б.М., Правила устройства електроустановок. Узгосенергонадзор. -Т.: 2007.

15.Аллаев К.Р., Енергетика мира и Узбекистана. Аналитичэский обзор. -Т.: Издателство «Молия», 2007.

Internet resources:

16.www.gov.uz – O‘zbekiston Respublikasining hukumat portali.

17.www.catback.ru– xalqaro ilmiy maqola va o‘quv materiallar sayti.

18.www.google.ru– xalqaro o‘quv materiallarining qidiruv sayti.

19.www.ziyonet.uz– milliy o‘quv materiallarining qidiruv sayti.

20.www.lex.uz– O‘zRes Qonun hujjatlari ma’lumotlari milliy bazasi.

21.www.catback.ru- научные стати и учебные материалы