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
Study to the program connection	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	8
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.
Student assessment	Assessment of student knowledge is based on the mastery of the learning material during the semester and final control (tests, assignments, written and oral work results). During the course of Power supply systems, students are evaluated on a 100-point system. Of these, 50 points are allocated to the current and intermediate results (60% of the 50 points are current control, independent study and 40% are intermediate control), and 50 points are allocated to the final control results. Students whose total score of current and intermediate points is less than 30 points are not admitted to the final control exam. A student who scores 30 or more points in the final control is considered to have mastered the subject.
Requirements for exams	The student must have fully mastered the theoretical and practical concepts of the subject, be able to correctly reflect the results of the analysis. The student must have completed the tasks given in the current and intermediate forms of independent work, assessment. At the same time, he must have received the necessary points from the current, intermediate, independent education and final tests in the relevant subject within the specified time. A student who has not submitted current control, intermediate control and independent education tasks, as well as who has scored less than 30 points on these tasks and types of control, will not be included in the final type of control. Also, a student who has missed 25 or more percent of the classroom hours allocated to the subject without an excuse will be expelled from this subject, will not be allowed to take the final exam and will be considered as not having mastered the relevant credits in this subject. A student who fails the final exam or scores less than 30 points on this type of exam is considered academically indebted.
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., "Електроснабжение 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