Name of subject	Electrical part of stations and substations (ECTS 9)
Subject/module code	SPEQ23409
Science taught semester (s).	3rd and 4th semester
Responsible teacher	Anarboyev Muhiddin Almanovich (PhD), associate professor
Education language	Uzbek
Study to the program connection	Elective
Training hours (this including independent education)	**Total hours-270.** **Audience Training hours - 108.** Lecture training hour – 60 Laboratory training hour – 24 Practical training hour – 24 **Independent education -162 hours**
ECTS	9
The purpose and tasks of subject / learning outcomes	**The purpose of teaching the subject** is to develop skills and competencies in students in the classification and structural structure of the energy sector, processes of electricity generation, and the effective operation of electrical devices under specific operating conditions.. **The task of the subject** is to the role of the electric power industry in the rapid development of the economy is incomparable. Due to the stable operation of the energy system of Uzbekistan, the national economy is provided with uninterrupted and high-quality electric energy. This process, in turn, increases the demand for training highly qualified personnel. This program reflects the goals, objectives, and content of the subject "Electrical part of the station and substation". In-depth study of the subject of the electrical part of the station and substation plays an important role in solving the problems of the harmful effects of energy on the environment. **Learning outcomes:** 1. The course on the electrical part of the station and substation studies the equipment of the electrical part of the station and substation in the electric power system. 2. High-voltage devices used in the electrical part of the station and substation. 3. Devices with voltages below 1000 V used in the electrical part of the station and substation. 4. Basic concepts in the field of electric power. 5. Basic performance indicators for various types of equipment 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.
Course content (topics)	**I. Main Theoretical Part (Lecture Sessions)** **Topic 1:** Introduction. Goals and objectives of the discipline "Electrical part of the station and substation". History of the development of electric power in Uzbekistan. Nominal voltage of the elements of the electrical system and operating modes of neutrals. **Topic 2:** Synchronous generators. Nominal parameters of generators. Structure of turbogenerators and hydrogenerators. Cooling system of generators. Air cooling systems. Hydrogen and water cooling systems of generators. **Topic 3:** Excitation systems of synchronous generators. Self-excitation and independent excitation systems of generators. **Topic 4:**Automatic adjustment of generator excitation. Field

quenching of synchronous generators. Synchronous compensators

Topic 5: Types of power transformers and their parameters.

Cooling systems of power transformers. Natural cooling with air and oil

Topic 6: Integration of power plants consisting of renewable energy sources into power networks.

Topic 7: Structure and operating modes of autotransformers. Voltage adjustment of transformers. transformer voltage adjustment under load. Voltage adjustment in autotransformers.

Topic 8: Low-voltage devices, switchgear and reclosers.

Topic 9: Distribution systems at power plants and substations.

Topic 10: High-voltage circuit breakers. Low-oil circuit breakers. Air circuit breakers. Electromagnetic, vacuum circuit breakers. Gas-insulated and synchronous circuit breakers.

Topic 11: Network problems, electrical systems and their design, load stabilization.

Topic 12: Voltage transformers.

Topic 13: Selection of basic electrical equipment and current-carrying parts. Switchgear, automatic machine, contactor, fuse. Selection of current transformers and voltage transformers.

Topic 14: Selection of current transformers and voltage transformers.

Topic 15: Electrical connection diagram of stations and substations. Basic requirements for the main diagrams of electrical installations.

II. Instructions and recommendations for organizing laboratory exercises.

In laboratory exercises, students develop practical skills and competencies in various indicators of processes in electrical part of stations and substations, conducting experiments, calculating and drawing tables and graphs. The recommended topics are selected based on opportunities and conditions.

Recommended topics for laboratory work:

1. Connecting synchronous generators to the power system.
2. Studying the operating modes of generators.
3. Studying the connection groups, schemes and main parameters of transformer windings.
4. Parallel operation of transformers
5. Studying the load capacity of transformers
6. Checking the insulation control scheme in an alternating current network
7. Checking current transformers.
8. Checking voltage transformers.
9. Checking the oil-immersed switch and its drive mechanisms.
10. Remote control of switches
11. Studying fuse-links
12. Determining the mutual electrodynamic voltages of the buses..

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. Selection of conductors for continuous current. 2. General information about digital substations 3. Single and double-strip tires. 4. Selection of low-voltage electrical equipment. 5. Selection of base insulators. 6. Selection of the number and power of insulators in the substation. 7. Selection of high-voltage electrical equipment. Selection of circuit breakers. 8. Selection of disconnectors. 9. Selection of short-circuit and dividers. 10. Selection of current transformers. 11. Selection of voltage transformers. 12. System diagrams of power plants and substations. Single-system busbar scheme. 13. Electric arc and methods of extinguishing it. Two-system busbar scheme. Single-circuit busbar and single-system busbar scheme. 14. Study of closed distribution devices and open distribution devices. The working bus system is a scheme of two working and circulating busbars, non-sectionalized and sectionalized. 15. Own demand systems of stations and substations **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. **Recommended topics for independent study:** 1. Operating modes of neutrals of electrical devices; 2. Electrical load graphs; 3. Automatic extinguishing of the generator field; 4. Neutral operating modes of power transformers in the power system and insulation testing; 5. Methods for calculating short circuits in power systems; 6. Thermal and dynamic effects of short circuit currents; 7. Electric arc and methods for extinguishing it; 8. Grounding devices; 9. Electrical connection schemes of stations and substations; 10. Own demand systems of power plants and substations;
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 Electrical part of stations and substations, students are evaluated on a 100-point system. Of these, 50 points are allocated to the current and intermediate results (60% of 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. Allaev K-P., Siddikov I.X., Xdkimov MD-, Ibragimov R.I., Siddikov O.I., SHamsutdinov X-F- «Stansiya va podstansiyalarning elektr jixozlari».-O‘quv qo‘llanma, T.: Cho‘lpon nomidagi NMIU, 2014. 2. Рожкова Л.Д. Карнеева Л.К. Чиркова Т.В.«Електрооборудование електрических станций и подстанций». Учебное пособие. 4-издания -М.:Издателский сентр «Академия», 2007. 3. Белецкий О.В., Лезнов С.И. «Обслуживание электрических подстанций». Учебное пособие. М.: энергоатомиздат, 1985. 4. Быстрицкий Г.Ф. Кудрин Б.И. «Выбор и эксплуататсия силовых трансформаторов». Учебное пособие для вузов. М.: Издателский сентр «Академия», 2003. 5. Неклепаев Б.Н. «Електрическая част станций и подстанций». Учебноепособие. - М.: энергоатомиздат, 1986. 6. Рожкова А.Д., Козулин Б.С. «Stansiya va podstansiyalarning elektr asbob-uskunalari». Darslik- T.: O‘qituvchi,1986. 7. Салов В.П. Справочник по ремонту, наладке и техническому обслуживанию электрооборудования. Учебное пособие. Издателство «Вента-2», 2007. 8.Majidov T.Sh. Noananaviy va qayta tiklanuvchi energiya manbalari, o‘quv qo‘llanma,-T.: 2014. 9.Taslimov A.D., Rasulov A.N., Usmonov E.G., Elektr taminoti, O‘quv qo‘llanma,-T.: “ILM ZIYO” nashriyoti, 2012. 10.S. Orifjonov “Elektromagnetizm” T. “Noshir” 2011. 11. A.A. Abdumalikov “Elektrodinamika” T. 2011. 12.К.Аллаев,”Энергетика мира и Узбекистана”2009г. **Additional literature:** 13. SH.Mirziyoev “Buyuk kelajagimizni mard va olijanob xalqimiz bilan birga quramiz” – T.: O‘zbekiston 2017. 14. O‘zbekiston Respublikasini yanada rivojlantirish bo‘yicha Xarakatlar strategiyasi to‘g‘risida. - T.:2017 yil 7 fevral, PF-4947-sonli Farmoni. 15. Чунихин А.А. электрических аппарат. –Учобное пособие , М: энергоатомиздат, 1988. 16. Неклепанов Б.Н. , И.П. Крючков. электрическая част стансий и потстанций. –М: энергоатомиздат, 1989. 17. AbduraxmanovK.P., ТигайО.Э., XamidovV.S. Комплекс мултимедийних лектсий, o‘zbek va rus tillarida. **Internet resources:** 18. www.gov.uz – O‘zbekiston Respublikasining hukumat portali. 19. www.catback.ru – xalqaro ilmiy maqola va materiallar sayti. 20. www.google.ru – xalqaro o‘quv materiallarini qidiruv sayti. 21. www.ziyonet.uz – milliy o‘quv materiallarini qidiruv sayti