Name of subject	**Energy audit of electrical systems (ECTS 8)**
Subject/module code	ETEA26708
Science taught semester (s).	6th and 7th semesters
Responsible teacher	Nazarov Furkat Daminovich, senior teacher.
Education language	Uzbek
Study to the program connection	Elective
Training hours (this including independent education)	**Total hours-240.** **Audience Training hours – 96** Lecture training hour – 48 Laboratory training hour – 24 Practical training hour – 24 **Independent education -144 hours**
ECTS	8
The purpose and tasks of subject / learning outcomes	The goal of teaching the subject is to teach students the fundamentals of rational use of energy, standardization of consumption by energy form, energy conservation management, use of secondary energy resources, and the implementation of energy conservation policies in practice. The task of the discipline is to evaluate methods for controlling current energy consumption at a facility, study energy management processes and practices, energy management information systems, energy audit methods, develop measures to increase energy efficiency, and study their feasibility. **Learning outcomes:** 1. Study the history and prospects of the development of the electric power system. 2. Get acquainted with the role and socio-economic significance of electric power in society. 3. Study the state policy of the energy sector and its development trends and prospects in the country and the world. 4. To have an idea of systematic analysis in solving organizational and technical issues in managing the energy sector of industrial enterprises. 5. Study of key performance indicators for various types of energy devices and opportunities for their improvement. 6. Economic assessment of service quality and its competitiveness by type of energy devices. 7. Knowledge of and ability to use the main legal and regulatory documents available in the field.
Course content (topics)	**I. Main Theoretical Part (Lecture Sessions)** **Topic 1:** Goals and objectives of instrumental energy audit at industrial enterprises **Topic 2:** Types and methods of measurements in instrumental energy audit **Topic 3:** Insulators and line fittings. Cable structure and cable lines. **Topic 4:** Standardization of electrical energy consumption at industrial enterprises **Topic 5:** Current state of energy consumption. Statistical reports. **Topic 6:** Direct measurement of energy and energy carrier consumption **Topic 7:** Partial and indirect measurement of energy and energy carrier consumption parameters **Topic 8:** World experience in the application of new energy-saving technologies in industry **Topic 9:** Assessment of electricity consumption by lighting systems

and electrical appliances

Topic 10: Assessment of electricity consumption by air conditioners and office equipment

Topic 11: Calculation of heat energy consumption by consumers

Topic 12: Energy balance and its types

Topic 13: Methods and equipment for conducting energy audits

Topic 14: Definitions for heat and electricity

Topic 15: Calculation of electricity consumption by consumers

Topic 16: Accounting for natural gas by consumers

Topic 17: Heat and gas supply systems of industrial enterprises

Topic 18: Energy saving due to reactive power compensation

Topic 19: Cross-sectional audit of energy consumption

Topic 20: Analysis of the efficiency of energy consumption at the facility

Topic 21: Definition of enterprises and buildings

Topic 22: Feasibility study of energy-saving measures

Topic 23: Development of energy-saving recommendations

Topic 24: Analysis of energy use by the end consumer.

II. Instructions and recommendations for organizing laboratory exercises.

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

Recommended topics for laboratory work:

1. Energy saving reserves and energy saving measures in various sectors of industry
2. World experience in the application of new energy-saving technologies in industry
3. Power supply system of industrial enterprises
4. Determination and adjustment of the efficiency of heat exchange devices used in industry
5. Heat and gas supply systems of industrial enterprises
6. Compilation of exergy balances of heat-consuming devices
7. Thermal schemes and efficiency of modern steam and gas plants.
8. Settlement with consumers for electricity at a flat rate
9. Correct selection of electric motors by power
10. Saving electricity using reactive power compensation
11. Examples of compiling an energy audit report
12. Calculation of the technical and economic efficiency of energy-saving measures.

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. Application of new energy-saving technologies in industrial heat supply systems
2. Assessment of energy consumption by electric heating and cooling

	devices 3. Assessment of energy consumption by steam heating devices 4. Steam-gas device with steam spraying 5. Energy efficiency in industry 6. Heat supply in compressor equipment utilization devices 7. Energy saving in the gas industry 8. Energy saving in boiler houses 9. Operating modes of boiler plants 10. Energy saving in heat supply systems 11. Reducing heat loss through the use of double-chamber windows 12. Infrared heating system for industrial facilities. **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. Comparison of energy consumption data 2. Cross-sectional energy consumption audit 3. Analysis of energy consumption efficiency at the facility 4. Description of the enterprise and buildings 5. Feasibility study of energy saving measures 6. Development of energy saving recommendations 7. Analysis of energy use by the end consumer 8. Energy distribution and energy conversion 9. Development and evaluation of energy consumption improvement projects 10. Energy saving in heat supply systems 11. Saving electricity using reactive power compensation 12. Feasibility study of energy saving measures 13. Development of energy saving recommendations 14. Analysis of energy use by the end consumer 15. Energy distribution and energy conversion 16. Development and evaluation of energy consumption improvement projects 17. Energy saving in heat supply systems 18. Reducing heat loss through the use of double-chamber windows 19. Energy saving in electrical networks.
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 Energy audit of electrical systems, 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. 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., Электроснабжения промышленных предприятий. Учебник. -М.: Интермет Инжиниринг, 2005. 4. Qodirov T.M., Alimov H.A., «Sanoat korxonalari elektr ta'minoti», O'quv qo'llanma, ToshDTU. -T.: 2006. 5. Qodirov T.M., Alimov H.A., «Sanoat korxonalari va fuqoro 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 Электр таъминоти. Ilm-ziyo. -T.: 2012. **Additional literature:** 7. O'zbekiston Respublikasini yanada rivojlantirish bo'yicha Harakatlar strategiyasi to'grisida-T.2017yil 7 fevral,PF-4947-sonli Farmoni. 8. Uzbekistan Respublikasi «Energiyadan oqilona foydalanish togrisida» qonuni. 2019 y. 9. Конюхова Е.А., Электроснабжение объектов: Учебное пособие. -М.: Издательство «Мастерство»; Высшая школа, 2001. 10. Ополева Г.Н., Схемы и подстанции электроснабжения: Справочник: Учебное пособие. - М.: ФОРУМ: ИНФРА-М, 2006. 11. Гулямов Б.Х., Салиев А.Г., Ташпулатов Б.Т., Тешабаев Б.М., Правила устройства электроустановок. Узгосэнергонадзор. -Т.: 2007. 12. Аллаев К.Р., Энергетика мира и Узбекистана. Аналитический обзор. -Т.: Издательство «Молия», 2007. 13. Аллаев К.Р., Электроэнергетика Узбекистана и мира. -Т.: «Фан ва технология», 2009. **Internet resources:** 16. www.lex.uz – National database of information on legal documents of the Republic of Uzbekistan. 17. www.ziyonet.uz – national educational materials search site. 18. www.gov.uz – Government portal of the Republic of Uzbekistan. 19. www.google.com – international educational materials search site. 20. www.energystrategy.ru – "Energy Policy and Strategy" information portal 21. www.twirpx.com – international educational materials search site.