Name of subject	Thermal Engineering and Hydropower (ECTS 11)
Subject/module code	ITG12310
Science taught semester (s).	2nd and 3rd semesters
Responsible teacher	Baratov Laziz
Education language	Uzbek
Study to the program connection	Compulsory
Training hours (this including independent education)	**Total hours - 330 .** **Audience Training hours** - 132. Lecture hours - 48 Laboratory hours - 36 Practical hours - 48 **Independent education - 198 hours**
ECTS	11
The purpose and tasks of subject / learning outcomes	**The goal of teaching science** is to develop knowledge, skills, and competencies in non-energy fields in each student studying in these areas, appropriate to the profile of the field, in terms of the laws of thermodynamics, types of heat engines, their structure, operation in cycles, and thermodynamic processes and heat transfer that occur in them. **The task of the subject** is to teach students the theory of the operation of heat engines, the laws of energy circulation, cycles and structure of energy devices, the processes that occur in them, as well as heat transfer and the principles of operation of thermal energy devices. **Learning outcomes:** 1. Study the history and prospects of the development of the electric power system. 2. Get acquainted with the laws of thermodynamics. 3. Study the types, structure, and operation of heat engines in cycles. 4. Study the laws of energy circulation in power plants. 5. Heat transfer and the principle of operation of heat power plants.
Course content (topics)	**I. Main theoretical part (Lecture)** **Topic 1:** Introduction to the subject of "Heat Engineering and Hydropower". History and development trends of thermodynamics and heat engineering **Topic 2**: Heat capacity. Molecular-kinetic theory of heat capacity of gases. **Topic 3:** Law of conservation and circulation of energy. Amount of work and heat in a thermodynamic process. I-th law of thermodynamics. **Topic 4:** Analysis of basic thermodynamic processes. **Topic 5:** Isobar, isochoric, isothermal, adiabatic and polytropic processes. **Topic 6:** Definitions of the II-th law of thermodynamics. Direct and inverse periodicity. Thermal efficiency of a heat device **Topic 7:** Water vapor and its properties. H-s diagram of water vapor **Topic 8:** Steam turbine devices. Rankine cycle. Cycles of a steam turbine device. **Topic 9:** Gas turbine device. Cycles of a gas turbine device. **Topic 10:** Fundamentals of heat transfer. Basic concepts. Heat transfer methods: heat conduction, convective heat transfer, radiation. Heat transfer. **Topic 11:** Fundamentals of convective heat transfer. Convective heat transfer **Topic 12:** Heat transfer. Heat transfer of a single and multi-layer flat wall under the boundary condition of the third order**.** **Topic 13:** Basic laws of heat transfer by radiation.

	Topic 14: Heat exchange devices. Types of heat exchange devices. Recuperative, regenerative and mixed heat exchange devices. **Topic 15:** Compressors, their types, structure and operating methods **II. Instructions and recommendations for organizing laboratory exercises.** In laboratory classes, students develop practical skills and competencies in various indicators of processes in electrical networks and systems, conducting experiments, calculating and drawing tables and graphs. The proposed topics are selected based on opportunities and conditions. **Recommended topics for laboratory work:** 1. Pressure and temperature measuring instruments; 2. Verification of the Boyle-Mariotte law; 3. Determination of the mass heat capacity of air; 4. Determination of the thermal conductivity of an insulating material; 5. Determination of the thermal conductivity of a horizontal pipe; 6. Operation of a single-stage piston compressor; **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. State parameters and equation of state; 2. Heat capacity 3. Isobar, isochoric, isothermal processes, 4. Adiabatic and polytropic processes; 5. Carnot cycle 6. Steam turbine device. Rankine cycle. 7. Heat transfer. 8. Heat exchangers. **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 for recommended topics:** 1. Ideal gas equation of state 2. Ideal gas mixtures 3. Heat capacity of ideal gases 4. I-law of thermodynamics 5. Isobaric, isochoric, isothermal, adiabatic and polytropic processes 6. II-law of thermodynamics 7. Cyclic processes. Carnot cycle 8. Heat conductivity of a flat wall and a cylindrical wall 9. Heat transfer 10. Laws of radiation. 10. Heat exchangers. 11. Gas turbine devices.

	12. Compressor devices.
Student assessment	Assessment of student knowledge is based on the mastery of the teaching materials during the semester and final control (tests, assignments, written and oral work results). During the course of Heat Engineering and Hydropower Engineering, 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. S. Kleein., G.Nellis. Thermodynamics. Cambridge, 2012 2. Alimova M.M., Mavjudova Sh.S., Isaxodjayev X.S., Raximjonov R.T., Umarjonova F.Sh. «Issiqlik texnikasining nazariy asoslari» fanidan tajriba ishlari to'plami. Uslubiy qo'llanma, 1-qism.-T.: Toshkent, ToshDTU, 2006. 3. Koroli M.A., Umarjonova F. Sh., Xoshimova F.A. Termodinamika. Issiqlik texnikasi. darslik. - Toshkent: BOOK TRADE KO, 2022 4. Mavjudova Sh.S. Termodinamika va issiqlik texnikasi. Darslik, – Toshkent.: Fan va texnologiyalar nashriyoti-matba uyi, 2022 5. Mavjudova Sh. S. Issiqlik texnikasi, O´quv qo´llanma.-Toshkent: O´zbekiston faylasuflari milliy jamiyati nashiriyoti, 2023. 6. Umarjonova F. Sh., Isaxodjaev X. S., Mavjudova Sh. S., Alimova L.O., Axmatova S. R. "Issiqlik texnikasi" fanidan laboratoriya ishlari to'plami. Uslubiy qo'llanma. – Toshkent, ToshDTU. 2014-94 b. 7. Uzoqov G'.N., Qodirov I.N., Isaxodjaev X.S.. Termodinamika. O'quv qo'llanma -Toshkent: Voris- Nashiriyot, 2018. 8. Zohidov R.A., Alimova M.M., Mavjudova SH.S. Texnik termodinamika va issiqlik uzatilishi fanidan masalalar to'plami. – Toshkent.: TDTU, 2006. **Additional literature** 1. Mirziyoyev Sh.M. Yangi O'zbekiston taraqqiyot strategiyasi. 2-to'ldirilgan nashr. – T.: O'zbekiston, 2022. – 44 b. 2. Islom Karimov nomidagi Toshkent davlat texnika universiteti talabalari mustaqil ta'limni tashkil etish bo'yicha Tartibi. – T.: ToshDTU, 10.06.2024. – 6 b. 3. В.П.Белоглазов. Теоретические основы теплотехники.

	Теплопередача. Нижневартовск, 2016 4. А.А.Яновский. Теплотехника. Уч. пособие. Ставрополь. 2020 5. Koroli M.A., Mavjudova SH.S. Zamonaviy pedagogik texnologiyalar. Metodik ishlanma. -Tashkent.: TDTU, 2003. **Internet sources:** 16. www.ziyonet.uz – milliy o‘quv materiallarini qidiruv sayti. 17. www.gov.uz – O‘zbekiston Respublikasining hukumat portali. 17. www.google.com – xalqaro o‘quv materiallarini qidiruv sayti. 19. www.energystrategy.ru – “Energetika siyosati va strategiyasi” axborot portali 20. www.twirpx.com – xalqaro o‘quv materiallarini qidiruv sayti.