Name of subject	Water Treatment Technology (ECTS 6)
Subject/module code	STT1106
Science taught semester (s).	2nd semester
Responsible teacher	Sultonov A., Associate Professor; Xolbutayev B., Associate Professor, "Engineering Communications" Department
Education language	Uzbek
Connection to the curriculum	Compulsory
Training hours (this including independent education)	**Total hours – 180.** **Audience training hours – 60.** Lecture training hours – 30 Practical training hours – 30 **Independent education – 120 hours** Course project
ECTS	6
The purpose and tasks of subject / learning outcomes	**The purpose of teaching the course –** to develop master's students' knowledge, skills and competencies in selecting water treatment equipment and methods according to consumer needs; understanding the role of the discipline in everyday life and industrial production, as well as technological requirements for water supply; and understanding the structure, types, scope of application and design principles of treatment facilities, including methods for selecting them to suit specific conditions. **The task of the course is** to teach master's students the composition and properties of wastewater; methods of wastewater treatment and sludge processing; the structure and types of water treatment facilities; the theory of operation of treatment methods; and selecting and calculating suitable facilities for the conditions of a particular water treatment system. **Prerequisites:** Physics and Mathematics; introductory knowledge of the specialty, water supply and wastewater collection systems, engineering drawings, modern design methods and tools, technical and software support, and automated control and design systems. **Learning outcomes:** 1. Understands the classification of water treatment units, equipment and facilities. 2. Knows and is able to use modern types of water treatment units, equipment and facilities and understands their characteristics. 3. Has the skills to determine the technical and economic efficiency of operating water treatment units, equipment and facilities. 4. Effectively operates wastewater treatment facilities and equipment. 5. Performs quality control. 6. Ensures industrial and occupational safety.
Course content (topics)	**I. Main Theoretical Part (Lecture Sessions)** **Topic 1:** Introduction to water treatment technology. **Topic 2:** Water supply systems and the requirements applicable to them. **Topic 3:** Integrated operation of water supply systems and their facilities. **Topic 4:** Water coagulation processes and equipment. **Topic 5:** Water treatment by screening. **Topic 6:** Water treatment by filtration. **Topic 7:** Clarifiers. **Topic 8:** Water disinfection. **Topic 9:** Iron removal from water. Desalination and softening. **II. 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. Study of water quality requirements and national standards. (2 hours) 2. Practical analysis of the joint operation of water supply systems and their facilities. (2 hours) 3. Solving practical problems on determining the composition of water treatment facilities. (2 hours) 4. Calculation of reagents and reagent facilities. Determination of coagulant and flocculant doses. (4 hours) 5. Types of sedimentation tanks and their calculation. (4 hours) 6. Water treatment by filtration. Filter calculations. (4 hours) 7. Calculation of horizontal and vertical sedimentation tanks. Contact clarifiers and their calculation. (4 hours) 8. Water disinfection. Determination of chlorination doses and residual chlorine concentration in water. (4 hours) 9. Calculation of iron salts and minerals in water. (4 hours) **III. 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. Natural water sources and bodies and their water quality indicators. Consumers' water quality requirements. (12 hours) 2. Official water quality standards. Study and analysis of the national drinking water standard O'zDSt 950-2011. (12 hours) 3. Main methods for assessing the quality indicators of natural waters and their treatment. (12 hours) 4. Water coagulation processes and equipment. Coagulants and their types in accordance with regulatory requirements. Flocculants and their types. (12 hours) 5. Water treatment by sedimentation. Types, designs and operating principles of sedimentation tanks. Their calculation. (12 hours) 6. Water treatment by filtration. Types of filters and filter media. (12 hours) 7. Horizontal, vertical and radial sedimentation tanks: operating principles, design and calculation. (12 hours) 8. Water disinfection. Methods of water disinfection. (12 hours) 9. Iron removal from water, desalination and softening. Design and calculation. (12 hours) 10. Natural water sources and bodies and their water quality indicators. Consumers' water quality requirements. (12 hours) **IV. Course project** **Topic:** Design calculations for industrial water supply networks. The aim of the course project is to develop students' ability to work independently, to develop practical skills in applying acquired theoretical

	knowledge, to make technical decisions suited to real production conditions, and to develop the ability to use modern equipment and technologies. The course project focuses on studying the composition and pollution level of wastewater generated by industrial enterprises, selecting an efficient technological treatment flow scheme, and calculating the technological and structural parameters of the main treatment facilities. Within the project, wastewater flow rates and physical, chemical and biological characteristics are determined, and treatment methods appropriate for reducing the identified pollutants are selected. The interrelationship between the mechanical, physicochemical and biological treatment stages is analysed. The project also evaluates compliance of the treated wastewater with established standards, protection of water resources, opportunities for reuse, and the environmental efficiency of the treatment process. The graphical part consists of 1–2 sheets of A2 drawing paper. The drawings show, without scale, equipment and chamber layouts, plans, sections, installation diagrams and connection diagrams to the network. The explanatory report comprises 20–25 pages and is prepared as follows: paper size – A2; margins – left 2.5 cm, right, top and bottom 2 cm; font – Times New Roman, 14 pt for the main text; paragraph indent – 1.25 cm; line spacing – 1.5; text justified; page numbers centred at the bottom of the page; language – Uzbek (Latin script).
Exam form	Written
Teaching/learning and examination requirements	**Teaching technologies and methods:** lectures; interactive case studies; seminars (logical thinking, rapid question-and-answer sessions); group work; giving presentations; individual projects. Students must fully master the theoretical and methodological concepts related to the course, correctly present the results of their analysis, independently reason about the processes under study, complete the tasks and assignments set for current and midterm assessments, and submit the required work for the final assessment. 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 student knowledge

5 grade	100 points		Assessment criteria
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. Rizaev A.N., Xudoyberganova N.T. “Physico-Chemical Treatment of Natural and Waste Waters”. Study guide. Tashkent: Lesson Press, 2021. 236 p. (in Uzbek)

2. Qutlimurodov U. “Water Supply and Wastewater Disposal Systems”. Textbook. Tashkent, 2021. 252 p. (in Uzbek)

3. Sultonov A.O., Gadayev A.N. “Design of Water Conveyance Networks”. Study guide. Tashkent, 14.04.2025. 197 p. (in Uzbek)

4. Qutlimurodov U.M., Musayev Sh.M. “Water Supply and

	Wastewater Disposal Systems". Textbook. Imperis Media. Tashkent, 06.11.2023. 246 p. (in Uzbek) 5. Alibekova N.N. "Design of Water Supply Systems of Industrial Enterprises". Study guide. Jizzakh, 2023. 101 p. (in Uzbek) **Additional literature** 6. QMQ 2.04.03-97. Sewerage. External networks and structures. Tashkent, 1997. 7. ShNQ 2.04.02-2019. Water supply. External networks and structures. Ministry of Construction of the Republic of Uzbekistan. Tashkent, 2019. 8. Lukinykh A.A., Lukinykh N.A. Tables for the Hydraulic Calculation of Sewer Networks Using Academician N.N. Pavlovsky's Formula. 4th edition. Moscow: Stroyizdat, 1974. 156 p. (in Russian) 9. Yakubov K.A., Bo'riyev E.S. "Wastewater Treatment". Textbook for higher education institutions. Tashkent, 2020. 220 p. (in Uzbek) 10. Current regulatory documents of the Republic of Uzbekistan in the field of construction. **Internet resources:** 1. www.gov.uz – Government portal of the Republic of Uzbekistan. 2. www.lex.uz – National database of legislation of the Republic of Uzbekistan. 3. https://t.me/archbookuz