Name of subject	**Water Supply and Wastewater Systems of Industrial Enterprises (ECTS 10)**
Subject/module code	SKSTOST12310
Science taught semester (s).	2nd and 3rd semesters
Responsible teacher	Sultonov A., Associate Professor, "Engineering Communications" Department
Education language	Uzbek
Connection to the curriculum	Compulsory
Training hours (this including independent education)	**Total hours – 300.** **Audience training hours – 90.** Lecture training hours – 46 Practical training hours – 44 **Independent education – 210 hours**
ECTS	10 (2nd semester – 6, 3rd semester – 4)
The purpose and tasks of subject / learning outcomes	**The purpose of teaching the course –** to provide master's students with knowledge of the technology of preparing water for industrial enterprises, the composition and properties of wastewater, methods of wastewater treatment and sludge processing, and the design, types and theory of operation of treatment facilities, and to teach them to select and calculate the most suitable facilities for the conditions of a particular treatment system. **The task of the course is** to give master's students in-depth knowledge of developing design documentation; carrying out architectural and construction, author's and technical supervision; assessing the environmental impact of a facility; selecting pumps and modelling their operation; using modern software for the design of hydraulic systems; hydraulic modelling of the operation of engineering communication networks; and the directions and problems of designing engineering communication facilities. **Prerequisites:** Mathematics, Physics, Chemistry; Water supply and wastewater disposal and treatment systems. **Learning outcomes:** 1. Has an understanding of the scientific and practical importance of wastewater disposal and treatment systems of industrial enterprises. 2. Has an understanding of the reuse of wastewater after treatment. 3. Knows the features of wastewater disposal systems of industrial enterprises. 4. Knows the features of the recirculating system in wastewater treatment. 5. Knows the water supply and wastewater disposal systems of industrial enterprises. 6. Has the skills to design and manage the water supply and wastewater disposal systems of industrial enterprises. 7. Is able to develop methods of water supply and wastewater treatment for industrial enterprises.
Course content (topics)	**I. Main Theoretical Part (Lecture Sessions)** **Topic 1:** Introduction to the course "Water Supply and Wastewater Disposal of Industrial Enterprises". **Topic 2:** Water supply systems of industrial enterprises and determination of water consumption. **Topic 3:** Water supply system at industrial enterprises. **Topic 4:** Recirculating water supply system of industrial enterprises. **Topic 5:** Fire water supply of industrial enterprises. **Topic 6:** Softening of water supplied to industrial enterprises. **Topic 7:** Methods of cooling industrial water. **Topic 8:** Desalination of industrial water.

Topic 9: Fluoridation and defluoridation of water.

Topic 10: Composition, properties and classification of wastewater.

Topic 11: Methods of treating the wastewater of industrial enterprises.

Topic 12: Facilities receiving the wastewater of industrial enterprises.

Topic 13: Methods of mechanical treatment of the wastewater of industrial enterprises.

Topic 14: Biological treatment of the wastewater of industrial enterprises.

Topic 15: Chemical and physico-chemical treatment of the wastewater of industrial enterprises.

Topic 16: Flotation. Adsorption.

Topic 17: Ion exchange. Extraction.

Topic 18: Electrochemical method of wastewater treatment.

Topic 19: Advanced treatment of wastewater discharged from industrial enterprises.

Topic 20: Methods of wastewater disinfection.

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. Water consumption of industrial enterprises. Determination of water consumption and the water balance form. (2 hours)
2. Water consumption norms and regime at industrial enterprises. (2 hours)
3. Determination of the total water consumption of industrial enterprises. (2 hours)
4. Schemes of water supply and wastewater discharge of industrial enterprises. (2 hours)
5. Calculation of an ion-exchange water desalination facility. (2 hours)
6. Determination of the flow of wastewater generated by an industrial enterprise and the water balance form. (2 hours)
7. Design and calculation of an equalization tank. (2 hours)
8. Calculation of screens and comminuting screens. (2 hours)
9. Calculation of grit chambers retaining mineral substances. (2 hours)
10. Calculation of wastewater clarifiers. (2 hours)
11. Calculation of settling tanks retaining coarse dispersed impurities. (2 hours)
12. Calculation of oil separation units. (2 hours)
13. Calculation of wastewater treatment units operating under centrifugal forces. (2 hours)
14. Calculation of flotation units for industrial wastewater. (2 hours)
15. Calculation of an ion-exchange unit. (2 hours)
16. Calculation of aeration tanks in wastewater treatment. Aeration and mass transfer. (2 hours)
17. Calculation of wastewater disinfection. (4 hours)
18. Calculation of secondary settling tanks in wastewater treatment. (2 hours)
19. Calculation of facilities for processing the sludge generated in

	wastewater treatment. (2 hours) 20. Drawing the master plan and longitudinal profile of wastewater treatment facilities. (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. Solving water supply problems in the Republic of Uzbekistan taking into account irrigation, maintaining the sanitary condition of water bodies and sewerage. (10 hours) 2. Development of water supply systems of industrial enterprises in the Republic of Uzbekistan. (10 hours) 3. Ways of reducing water consumption for the needs of industrial enterprises. (10 hours) 4. Water supply systems for industrial enterprises. (10 hours) 5. Cooling units and their types. (10 hours) 6. Methods of softening, desalting and desalinating water for industrial enterprises. (10 hours) 7. Degassing of water for industrial enterprises. (10 hours) 8. Disinfection of water for industrial enterprises. (10 hours) 9. Sources of wastewater generation at industrial enterprises. (10 hours) 10. Systems for discharging small amounts of industrial wastewater into water bodies. (10 hours) 11. Determination of the amount and degree of pollution of water at industrial enterprises. (10 hours) 12. Conditions for accepting industrial wastewater into the city sewerage network. (10 hours) 13. Technical and economic assessment of the mechanical treatment of industrial wastewater. (10 hours) 14. Systems for discharging low volumes of industrial wastewater into water bodies. (10 hours) 15. Types of industrial wastewater receiving facilities. (10 hours) 16. Determination of the required degree of treatment of industrial wastewater discharged into water bodies. (10 hours) 17. Conditions for accepting the wastewater of industrial enterprises into city sewerage systems. (10 hours) 18. Chemical treatment of the wastewater of industrial enterprises. (10 hours) 19. Physico-chemical treatment of the wastewater of industrial enterprises. (10 hours) 20. Methods and facilities for processing the sludge of industrial wastewater. (10 hours) 21. Design of systems for discharging the wastewater of industrial enterprises. (10 hours)
Exam form	Written
Teaching/learning and examination requirements	**Teaching technologies and methods:** lectures; interactive case studies; presentations; group work; brainstorming, cluster, blitz survey; team projects to be completed and defended; logical thinking and rapid questions and answers. Full mastery of the theoretical and methodological concepts of the course, completion of the tasks and assignments set in the current and midterm assessments, and submission of a written paper 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	10 points	

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<tr><td></td><td></td><td>seminars, practical, laboratory classes)</td><td></td><td></td></tr>
<tr><td rowspan="2">Midterm assessment</td><td rowspan="2">20 points</td><td>Supervision: Written work</td><td>10 points</td><td rowspan="2">12 points</td></tr>
<tr><td>System tasks</td><td>10 points (divided by the number of tasks)</td></tr>
<tr><td>Final assessment</td><td>50 points</td><td>Written assignment (5 questions)</td><td>50 points (10 points per question)</td><td>30 points</td></tr>
<tr><td colspan="5">* 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.</td></tr>
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<tr><td>Recommended Literature</td><td>
Main literature:
1. Sultonov A.O. “Use and Protection of Water Resources”. Study guide. Jizzakh, 2025. 136 p. (in Uzbek)
2. Gadaev A.N., Sultonov A.O. “Design of Water Conveyance Networks”. Textbook. Jizzakh, 2025. 184 p. (in Uzbek)
3. Alibekova N.N. “Design of Water Supply Systems of Industrial Enterprises”. Study guide. Jizzakh, 2023. 107 p. (in Uzbek)
4. Aliev M.K. “Wastewater Treatment Technology”: textbook for construction specialties of higher education institutions. – Tashkent, 2021. (in Uzbek)
5. Qutlimurodov U.M. “Water Supply and Wastewater Disposal Systems”. Study guide. “Minus design group” LLC, 2021. 210 p. (in Uzbek)
Additional literature
6. Turobjonov S.M., Tursunov T., Pulatov X. “Wastewater Treatment Technology”. Textbook. – Tashkent: Musiqa, 2010. (in Uzbek)
7. Djalilova A., Xamidov A., Abduqodirova M. “Sewerage and Wastewater Treatment”. Study guide. – Tashkent: Voris-nashriyot, 2012. (in Uzbek)
8. ShNQ 2.04.02-97. Water supply. External networks and structures. – Tashkent: State Committee of the Republic of Uzbekistan for Architecture and Construction, 1997.
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
4. www.twirpx.com – website for students.
5. www.taqi.uz – website of the Tashkent Institute of Architecture and Civil Engineering.
6. www.aircleaning.ru
7. www.pkf-sinergia.ru
8. www.do.gendocs.ru
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