Name of subject	Wastewater Treatment Technology (ECTS 10)
Subject/module code	OST1208 (master's)
Science taught semester (s).	2nd and 3rd semesters
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 – 300.** **Audience training hours – 90.** Lecture training hours – 46 (2nd semester – 16, 3rd semester – 30) Practical training hours – 44 (2nd semester – 14, 3rd semester – 30) **Independent education – 210 hours (2nd semester – 74, 3rd semester – 136)** Course project – 3rd semester
ECTS	10 (2nd semester – 4, 3rd semester – 6)
The purpose and tasks of subject / learning outcomes	**The purpose of teaching the course –** to develop in master's students knowledge, skills and competencies appropriate to their specialisation in wastewater treatment and sludge processing methods for wastewater generated in cities and industrial enterprises; the structure, types and fields of application of the facilities used; the principles of their calculation; and methods for selecting suitable facilities for specific conditions. **The task of the course is** that the master's student studies the composition and properties of wastewater, methods of wastewater treatment and sludge processing, and the structure and types of treatment facilities; understands the operating principles of these facilities; and learns to select and calculate the most suitable facilities for specific wastewater treatment system conditions. **Prerequisites:** Physics and Mathematics; introduction to the specialty; water supply and wastewater collection systems; knowledge and understanding of modern methods and tools for engineering drawing and design, technical and software support, and automated control and design systems. **Learning outcomes:** 1. Analyses the composition of wastewater and its pollutants. 2. Selects appropriate wastewater treatment methods. 3. Develops wastewater treatment process flow diagrams. 4. Uses wastewater treatment facilities and equipment efficiently. 5. Performs quality control. 6. Ensures industrial safety.
Course content (topics)	**I. Main Theoretical Part (Lecture Sessions)** **Semester II** **Topic 1:** Introduction. General overview of wastewater treatment technologies. **Topic 2:** Screens. **Topic 3:** Grit chambers. **Topic 4:** Sedimentation tanks. **Topic 5:** Two-storey settling tanks. **Topic 6:** Oil separators. **Topic 7:** Separators. **Topic 8:** Slow filters. **Semester III** **Topic 9:** Rapid filters.

Topic 10: Microfilters.
Topic 11: Rotary drum filters.
Topic 12: Hydrocyclones.
Topic 13: Equipment used to carry out the coagulation process.
Topic 14: Flotation units.
Topic 15: Collectors and channels.
Topic 16: Flotation units operating by the foam fractionation method.
Topic 17: Adsorbers.
Topic 18: Single-stage adsorbers with suspended mixers.
Topic 19: Ion exchangers.
Topic 20: Continuous-operation ion exchangers.
Topic 21: Pneumatic-pulsation regeneration ion exchangers.
Topic 22: Extractors.
Topic 23: Degassing method.

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:

Semester II

1. Theoretical foundations of wastewater treatment technology. (2 hours)
2. Determining the spacing between screen bars. (2 hours)
3. Design calculations for grit chambers. (2 hours)
4. Two-storey settling tanks. (2 hours)
5. Methods of mechanical wastewater treatment. (2 hours)
6. Separation of petroleum products from water. (2 hours)
7. Types of separators. (2 hours)

Semester III

8. Filtration of emulsified substances. (4 hours)
9. Information on filter media. (4 hours)
10. Applications of coagulation and flocculation methods. (4 hours)
11. Applications of flotation and adsorption methods. (4 hours)
12. Applications of hydrocyclone equipment in wastewater treatment. (4 hours)
13. Flotation units operating by the foam fractionation method. (2 hours)
14. Principles of ion exchange and extraction methods in wastewater treatment. (2 hours)
15. Information on ion-exchange reactions. (2 hours)
16. Methods of treating wastewater from agriculture. (2 hours)
17. Determining the conditional degree of wastewater treatment. (2 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:

	Semester II 1. Design of wastewater treatment technology for a metallurgical plant. (12 hours) 2. Design of wastewater treatment technology for knitting factories. (12 hours) 3. Design of wastewater treatment technology for textile factories. (12 hours) 4. Design of wastewater treatment technology for a sugar production plant. (12 hours) 5. Separation of suspended particles by centrifugal force. (12 hours) 6. Anodic oxidation and cathodic reduction. (14 hours) **Semester III** 7. Design of a wastewater treatment technology for a polystyrene plant. (18 hours) 8. Design of wastewater discharge systems for industrial enterprises. (18 hours) 9. Physicochemical treatment of wastewater from industrial enterprises. (20 hours) 10. Design of wastewater treatment technology for a leather-processing factory. (20 hours) 11. Design of wastewater treatment technology for an automobile plant. (20 hours) 12. Design of wastewater treatment technology for a chemical engineering plant. (20 hours) 13. Design of wastewater treatment technology for a manufacturing plant. (20 hours) **IV. Course project (Semester III)** **Topic:** Design calculations for the wastewater treatment technology of an industrial enterprise. 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 explanatory note 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; first-line indent – 1.25 cm; line spacing – 1.5; text justified; page numbers centred at the bottom of the page. Language: English.
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. Full mastery of the theoretical and methodological concepts related to the course; correct presentation of the results of analyses; independent reasoning about the processes being studied; completion of the tasks and

	assignments set for current and midterm assessments; and submission of the final assessment task. 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	18 points

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<tr><td rowspan="2"></td><td rowspan="2"></td><td></td><td>of tasks)</td><td rowspan="2"></td></tr>
<tr><td>Student activity (in seminars, practical, laboratory classes)</td><td>10 points</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 colspan="5">
Main literature:
1. Qutlimurodov U. “Water Supply and Wastewater Disposal Systems”. Textbook. Tashkent, 2021. 252 p. (in Uzbek)
2. Sultonov A.O., Gadayev A.N. “Water Supply and Sewerage”. Tashkent, 14.04.2025. 197 p. (in Uzbek)
3. Alibekova N.N. “Design of Water Conveyance Networks”. Textbook. JizPI printing house, 2023. 196 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
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