Name of subject	Use of Alternative Energy Sources (ECTS 4)
Subject/module code	MEMF2204
Science taught semester (s).	2nd semester
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 – 120.** **Audience training hours – 36.** Lecture training hours – 18 Practical training hours – 18 **Independent education – 84 hours**
ECTS	4
The purpose and tasks of subject / learning outcomes	**The purpose of teaching the course –** to study the course “Use of Alternative Energy Sources”; to introduce students of higher education institutions studying in the field of engineering communication systems, construction and installation to modern methods of saving the energy consumed by heating, ventilation and air conditioning systems; and to develop knowledge, initial skills and competences regarding the alternative methods of energy production that are developing today. **The task of the course is** to give students, in order to achieve this aim, theoretical knowledge and practical skills, knowledge of the possibility of saving fossil fuels through the use of renewable energy resources in heating, ventilation and air conditioning systems, and to teach modern design methods. **Prerequisites:** Physics; Fundamentals of thermodynamics and heat engineering; Heat and gas supply and ventilation systems. **Learning outcomes:** 1. Has an understanding of heat supply, steam and water heat supply, and heat loads. 2. Has an understanding of laying heat networks, the structural elements of heat networks, heat substations and methods of heat exchange. 3. Has an understanding of the main types of heating appliances, hot water supply systems, and saving heat energy and gas. 4. Has an understanding of city gas supply systems, the structure of building gas networks and the laying of gas pipelines. 5. Has an understanding of the energy efficiency of systems and of heat and gas supply systems and equipment. 6. Has the skills to solve problems of automating the operation of heat substations and pumping stations. 7. Has the skills to solve problems of adjusting heat and gas loads.
Course content (topics)	**I. Main Theoretical Part (Lecture Sessions)** **Topic 1:** Introduction to the course “Use of Alternative Energy Sources”. Classification of alternative energy sources. **Topic 2:** Current state and prospects of the use of alternative energy sources in Uzbekistan. **Topic 3:** General information on solar energy. Solar radiation. Solar radiation outside the Earth’s atmosphere. **Topic 4:** Direct-gain spaces, attached sunspaces, heat-storage walls, etc. Efficient use of the architectural and planning solutions of buildings in passive solar heating systems. Solar houses. **Topic 5:** Prospects for the use of wind energy in Uzbekistan. Classification of wind installations. Horizontal- and vertical-axis wind installations. **Topic 6:** Use of the energy of natural waters. Basic principles of using

	water energy. Hydropower. Use of geothermal waters. **Topic 7:** Use of biomass and environmental energy. Use of biomass. Biogas production technology. **Topic 8:** Heat pumps. Economic conditions for the use of heat pumps. **Topic 9:** Non-traditional energy sources. Wave power plants. Energy of the sea water temperature gradient. **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. Determination of the heat loads for heating, ventilation and hot water supply of residential buildings, neighbourhoods and a district. (2 hours) 2. Hydraulic calculation of water heat networks. (2 hours) 3. Calculation of mechanical equipment, supports and expansion joints in heat networks. (2 hours) 4. Calculation and selection of pipes, pumps and storage tanks in hot water supply systems. (2 hours) 5. Calculation of instantaneous and storage water heaters. (2 hours) 6. Methods of pressure and temperature control in hot water supply. (2 hours) 7. Calculation of the hourly and annual gas consumption of a district. Calculation of a gas pressure regulating station. (2 hours) 8. Hydraulic calculation of medium- and low-pressure gas networks. (2 hours) 9. Industrial gas supply systems. (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:** 1. Main heat consumers. (5 hours) 2. Methods of connecting local heat consumers to the heat network. (5 hours) 3. Steam and water heating systems. (5 hours) 4. Air heating systems. (5 hours) 5. Non-traditional heating systems. (4 hours) 6. Equipment of heat substations. (4 hours) 7. Water and steam heat supply systems. (4 hours) 8. Thermal insulation of heat networks. (4 hours) 9. Method of calculating insulation thickness. (4 hours) 10. Commissioning, adjustment, testing and operation of heat networks. (4 hours) 11. Modern heating appliances. Radiators and their types. (4 hours) 12. Normal and standard conditions of gases. (4 hours) 13. Gas heating systems. (4 hours) 14. Domestic gas appliances and their installation. (4 hours)

	15. Methods of converting heating boiler houses to gas. (4 hours) 16. Safety rules for the use of gas networks. (4 hours) 17. Organization of work on safety rules. (4 hours) 18. Types of corrosion in gas pipelines. (4 hours) 19. Electrochemical corrosion. (4 hours) 20. Protection of gas pipelines against corrosion. (4 hours)
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; preparing presentations; individual projects; team projects to be completed and defended. Full mastery of the theoretical and methodological concepts of the course, the ability to present the results of analysis correctly, independent reasoning about the processes being studied, completion of the tasks and assignments set in the current and midterm forms of assessment, 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 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. Tashmatov N.U. “Heat and Gas Supply Systems”. Textbook. Jizzakh: JizPI, 2021. 186 p. (in Uzbek)
2. Saydullayev S.R. “Engineering Communications of Buildings”. Textbook. Jizzakh, 2022. 246 p. (in Uzbek)
3. Mamajonov T., Nurmanov S.R. “Heat Supply”. Study guide. Tashkent: TAQI, 2018. 200 p. (in Uzbek)
4. Mansurova Sh.P. “Use and Protection of Water and Energy Resources”. Study guide. Jizzakh: JizPI, 2024. 142 p. (in Uzbek)

Additional literature

5. Farmanov Sh.V. “Underground Gas Storage”. Textbook. Tashkent: TSTU, 2015. 160 p. (in Uzbek)
6. Toshmatov N., Mansurova Sh. “Fundamentals of Heat and Gas Supply and Ventilation”. Study guide. Jizzakh: JizPI, 2026. 127 p. (in Uzbek)
7. QMQ 2.01.01-22. Climatic and physical-geological data for design. State Committee of the Republic of Uzbekistan for Architecture and Construction. Tashkent, 2022. 31 p.
8. QMQ 2.04.06-18. Building heat engineering. State Committee of the Republic of Uzbekistan for Architecture and Construction. Tashkent, 2018. 38 p.
9. ShNQ 2.04.07-22 “Heat networks”. Urban planning norms and rules.
10. ShNQ 2.04.14-22 “Thermal insulation of equipment and pipelines”. Urban planning norms and rules.
11. QMQ 2.04.16-18. Heating, ventilation and air conditioning. State

	Committee of the Republic of Uzbekistan for Architecture and Construction. Tashkent, 2018. 110 p. **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. www.prezident.uz – Press service of the President of the Republic of Uzbekistan. 4. www.scopus.com – international scientific database. 5. t.me/minstroyuz – official channel of the Ministry of Construction and Housing and Communal Services. 6. t.me/arxitektura_olam – Telegram group. 7. t.me/qurilish_maslahatlari – Telegram group. 8. t.me/jizpiarm – official channel of the electronic library of the Information Resource Centre of Jizzakh Polytechnic Institute.