Name of subject	Air Conditioning Systems (ECTS 4)
Subject/module code	HMT4704
Science taught semester (s).	7th semester
Responsible teacher	Sattorov A., Associate Professor; Xolboyev Y., Assistant, "Engineering Communications" Department
Education language	Uzbek
Connection to the curriculum	Elective
Training hours (this including independent education)	**Total hours – 120.** **Audience training hours – 48.** Lecture training hours – 24 Practical training hours – 24 **Independent education – 72 hours**
ECTS	4
The purpose and tasks of subject / learning outcomes	**The purpose of teaching the course –** to develop in students sufficient knowledge, skills and competences in calculating the ventilation and air conditioning systems of industrial buildings and in improving indoor air parameters. **The task of the course is** to study the selection of parameters in the creation and design of air conditioning systems, the placement of the equipment and fittings in the system, the types and application of installation work, the types and methods of testing, and the operation of the systems. **Prerequisites:** Physics; Mathematics. **Learning outcomes:** 1. Designs and calculates engineering communication systems using modern computer programs. 2. Carries out design work independently and as part of a team using modern information and communication technologies. 3. Uses digital technologies and software products effectively in professional activity. 4. Models air conditioning systems on a computer. 5. Performs calculations of air conditioning systems and selects air ducts. 6. Performs hydraulic calculations of air conditioning system networks. 7. Analyses and optimizes the operating efficiency of engineering systems.
Course content (topics)	**I. Main Theoretical Part (Lecture Sessions)** **Topic 1:** Introduction. Importance and methods of the course "Air Conditioning Systems". Physical properties of atmospheric air. **Topic 2:** Heat and moisture diagram of atmospheric air and the processes occurring in it. Instruments and equipment used in measurements. **Topic 3:** Explosion hazard from mixtures of gases and vapours at industrial enterprises and emergency ventilation. **Topic 4:** Air and air-thermal curtains. Schemes of air-thermal curtains. Classification of air-thermal curtains. **Topic 5:** Local exhaust ventilation and ventilation equipment used in laboratory production. **Topic 6:** Ventilation of residential, public and industrial buildings. **Topic 7:** Calculation of the amount of heat lost from buildings. **Topic 8:** Heat gains to premises. Specific heat quantity. **Topic 9:** Construction of the thermal state of air in summer. **Topic 10:** Construction of the thermal state of air in winter. **Topic 11:** Air conditioning of industrial enterprises. Design and operation of standard air conditioners. **Topic 12:** Automatic control of ventilation, air conditioning and

heating systems.

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. Heat and moisture diagram of atmospheric air. (2 hours)
2. Causes of the formation of substances polluting the environment at industrial enterprises. (2 hours)
3. Technological measures to reduce the amount of harmful emissions released into the atmosphere. (2 hours)
4. Selection and calculation of fans. (2 hours)
5. Calculation of the heat balance. (2 hours)
6. Calculation of the ventilation systems of the premises of industrial enterprises. (2 hours)
7. Calculation of the heating systems of the premises of industrial enterprises. (2 hours)
8. Calculation of the air conditioning systems of the premises of industrial enterprises. (2 hours)
9. Refrigerating machines. (2 hours)
10. Calculation of heat and mass transfer processes on the I-d diagram. (2 hours)
11. Purpose and types of air heating systems and their calculation. (2 hours)
12. Air heaters (calorifiers) and their calculation. (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. Balance equation of air and harmful substances in a room. (4 hours)
2. Calculation of the air exchange rate in a room. (4 hours)
3. Aerodynamic foundations of organizing air exchange in rooms. (4 hours)
4. Fundamentals of building aerodynamics. (4 hours)
5. Aeration of industrial buildings. (4 hours)
6. Pneumatic transport of materials and waste. (4 hours)
7. Noise and vibration control in ventilation systems. (4 hours)
8. Testing and adjustment of ventilation systems. (4 hours)
9. Air conditioning. (4 hours)
10. Ventilation equipment of painting shops. (4 hours)
11. Ventilation equipment of electroplating shops. (4 hours)
12. Ventilation of mechanical assembly shops. (4 hours)
13. Ventilation equipment of hot shops. (4 hours)
14. Ventilation systems of assembly and welding shops. (4 hours)
15. Ventilation of woodworking enterprises. (4 hours)
16. Cyclones of the aspiration and pneumatic transport systems of the wood-processing industry. (4 hours)

	17. Harmful emissions in industrial buildings. (4 hours) 18. Methods of determining heat and moisture release in industrial buildings. (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; giving presentations; individual projects. 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 the assessment task 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. Nurmanov S.R., Pirnazarov I.I., Usmanov Sh.A. “Ventilation and Air Conditioning Systems”. Study guide. Tashkent, 2019. (in Uzbek)
2. Qudratov A. “Industrial Ventilation”. Textbook. Tashkent, 2009. (in Uzbek)
3. Mansurova Sh.P. “Ventilation and Air Conditioning Systems”. Textbook. Jizzakh, 2023. (in Uzbek)
4. Rashidov Yu.K. “Heat and Gas Supply and Ventilation”. Textbook. Tashkent: Cho‘lpon, 2010. 143 p. (in Uzbek)
5. Rashidov Yu.K., Saidova D.Z. “Heat and Gas Supply and Ventilation”. Study guide. Tashkent: TAQI, 2002. 146 p. (in Uzbek)
6. Saidova D.Z., Nurmanov S.R. “Ventilation”. Study guide. Tashkent: TAQI, 2013. 173 p. (in Uzbek)

Additional literature

7. Kochev A.G. “Ventilation of Industrial Buildings and Structures”. Nizhny Novgorod: NNGASU, 2011. 178 p. (in Russian)
8. Borovitsky A.A., Ugorova S.V., Tarasenko V.I. “Modern Industrial Ventilation”. Study guide. Vladimir: Vladimir State University, 2011. 59 p. ISBN 978-5-9984-0180-0. (in Russian)
9. Bogoslovsky V.N., Kokorin O.Ya., Petrov L.V. “Air Conditioning and Refrigeration Supply”. Moscow: Stroyizdat, 1985. (in Russian)
10. Ananyev V.A. et al. “Ventilation and Air Conditioning Systems. Theory and Practice”. Study guide. Moscow: Evroklimat, Arina, 2000. 216 p. (in Russian)
11. Bogoslovsky V.N. “Heating and Ventilation”. Part II “Ventilation”. Textbook. Moscow: Stroyizdat, 1976. 439 p. (in Russian)

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. http://www.ziyo.net.uz 4. http://www.Valtec.ru 5. http://www.Vent.ru 6. http://www.energ.narod.ru