| **Name of subject** | **Computer-Aided Calculation of Engineering Utility Systems (ECTS 6)** |
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| Subject/module code | KDAMK2406 |
| Science taught semester (s). | 4nd semester |
| Responsible teacher | Saydullayev Sirojiddin Rahmatullayevich, Associate Professor, Musayev Sharof Mamarajabovich, Associate Professor |
| Education language | Uzbek |
| Connection to the curriculum | Elective |
| Training hours (this including independent education) | **Total hours-180.**<br>**Audience Training hours - 72.**<br>Lecture training hour – 24<br>Practical training hour – 48<br>**Independent education -108 hours** |
| ECTS | 6 |
| The purpose and tasks of subject / learning outcomes | **The purpose of teaching science -** The aim of the course is to develop students' theoretical knowledge and practical skills in designing engineering utility systems (heating, ventilation, air conditioning, gas supply, water supply and sewerage systems) using modern computer software; performing hydraulic and thermal calculations; selecting system components; modelling and analysing engineering systems; and preparing design documentation.<br>**The task of science is to** reveal the role and importance of science in human life and society by providing students with theoretical knowledge, practical skills, a methodological approach to financial phenomena and processes, and a scientific worldview.<br>**Learning outcomes:**<br>1. learn the principles of designing engineering utility systems using computer technologies;<br>2. become familiar with the capabilities of modern software such as AutoCAD, Revit MEP, MagiCAD, Audytor, DIALux, EPANET, WaterCAD and other relevant applications;<br>3. perform thermal and aerodynamic calculations of heating systems;<br>4. carry out hydraulic calculations of water supply and sewerage systems using specialised computer software;<br>5. develop skills in selecting pipes, valves and fittings, pumps, fans and other equipment based on calculation results;<br>6. develop the ability to formulate energy-efficient engineering solutions that comply with applicable regulatory requirements;<br>7. acquire competencies in independently developing engineering projects using modern information and communication technologies and applying the acquired knowledge and skills in professional practice. |
| Course content (topics) | **I. Main Theoretical Part (Lecture Sessions)**<br>**Topic 1:** Digital Design Tools.<br>**Topic 2:** Energy Calculations and Building Simulation.<br>**Topic 3:** Analysis of Computer Software Used in the Calculation and Design of Building Heating Systems.<br>**Topic 4:** Calculation of Heating System Equipment and Components.<br>**Topic 5:** Procedure for Performing Heat Supply Calculations for Underfloor and Wall Heating Systems Using Calculation Software.<br>**Topic 6:** Calculation of Water Supply and Wastewater Drainage Systems.<br>**Topic 7:** Hydraulic Calculation of Heating, Hot Water Supply and Water Supply Pipelines. Calculation of Chimneys.<br>**Topic 8:** Fundamentals of Using VALTEC CO 3.8 Software for |

Heating System Design.

**Topic 9:** Information on Equipment in the Form of Graphic Diagrams in VALTEC CO 3.8 Software.

**Topic 10:** Creating Diagrams and Entering Information about Equipment Components in VALTEC CO 3.8 Software.

**Topic 11:** Fundamentals of Editing and Data Entry in VALTEC H2O Software.

**Topic 12:** Importing Construction Drawings into VALTEC H2O Software and Entering Project Data into Tables.

## 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. Introduction to Computer Software and Exploration of Its Capabilities.
2. Thermotechnical Calculation of Building Envelope Structures Using Computer Software.
3. Calculation of Heat Loads, Airflow Rates, Pipe Diameters and Hydraulic Parameters.
4. Calculation of Heat Losses Through Building Envelope Structures Using Computer Software.
5. Entering Room Dimensions, Indoor and Outdoor Temperatures, Building Construction Data and Thermal Parameters.
6. Thermal Calculation of Heating Appliances Using Computer Software.
7. Performing Thermal Calculations for Underfloor Heating Systems.
8. Performing Thermal Calculations for Wall Heating Systems.
9. Hydraulic Calculation of Heating Systems Using Computer Software.
10. Determination of Water Consumption Standards and Regulations Using Computer Software.
11. Determination of Design Water Consumption Rates Using Computer Software.
12. Hydraulic Calculation of Water Supply Pipelines.
13. Selection of Diameters for Different Types of Valves, Fittings and Equipment.
14. Studying the Operating Principles and Basic Functions of VALTEC CO 3.8 Software for Heating System Design.
15. Entering Equipment Data in the Form of Graphic Diagrams in VALTEC CO 3.8 Software.
16. Creating Diagrams and Entering Heating System Equipment Components in VALTEC CO 3.8 Software.
17. Drawing and Editing Graphic Elements of Images in VALTEC CO 3.8 Software.
18. Installing Radiators in Rooms and Entering Their Technical Data in VALTEC CO 3.8 Software.
19. Installing Valves and Fittings for Heating Systems and Entering

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| | Their Technical Data in VALTEC CO 3.8 Software.<br>20. Introduction to the Fundamentals of Editing in VALTEC H2O Software.<br>21. Entering Data and Importing Building Construction Drawings into VALTEC H2O Software.<br>22. Entering Data into Tables, Drawing and Editing Graphic Elements in VALTEC H2O Software.<br>23. Working with the Drawing Tools Panel and Performing Calculations in VALTEC H2O Software.<br>24. Working with Calculation Results, Detailed Schematic Diagrams and Tables in VALTEC H2O Software. Installing Equipment and Valves for Building Water Supply Networks and Entering Their Technical Data.<br><br>**IV. Independent learning and independent work.**<br>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.<br>**Recommended topics for independent study:**<br>1. Selection of Outdoor and Indoor Air Parameters for the Design of Engineering Utility Systems.<br>2. Determination of Heating Loads for Residential and Public Buildings.<br>3. Heat Transfer Fluids and Temperature Control Schedules for Heat Supply Systems.<br>4. Calculation of Equipment in Heat Supply Systems Using Computer Software.<br>5. Identification of Types and Technical Parameters of Modern Engineering Utility Equipment.<br>6. Determination of Technical Specifications of Modern Heating Equipment and Components.<br>7. Thermotechnical Calculation of Building Envelope Structures Using Computer Software.<br>8. Calculation of Heat Losses Through Building Envelope Structures Using Computer Software.<br>9. Thermal Calculation of Heating Appliances Using Computer Software.<br>10. Thermal Calculation of Underfloor Heating Systems.<br>11. Thermal Calculation of Wall Heating Systems.<br>12. Hydraulic Calculation of Heating Systems Using Computer Software.<br>13. Determination of Water Consumption Standards and Regulations Using Computer Software.<br>14. Fundamentals of Using VALTEC CO 3.8 Software for Heating System Design.<br>15. Installation and Selection of Heating System Equipment Using VALTEC CO 3.8 Software.<br>16. Calculation of Heat Losses in Rooms.<br>17. Introduction to the Fundamentals of Editing in VALTEC H2O Software.<br>18. Setting the Required Input Parameters and Entering Data in VALTEC H2O Software. |
| Exam form | Written |
| Teaching/learning and examination requirements | Complete mastery of theoretical and methodological concepts and practical knowledge of the discipline, the ability to correctly reflect the results of analysis, independently reason about the processes being |

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| | studied and carry out tasks in the current, intermediate forms of control and independent work, pass written work on the final control.<br>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.<br>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.<br>The teacher who taught the students in this discipline is not involved in the process of conducting the exam and checking the students' answers.<br>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<br>Purpose: Determining and assessing the student's level of knowledge, practical skills, and competencies on course topics.<br>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.<br>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.<br>MIDTERM CONTROL<br>Purpose: Assessing the student's knowledge and practical skills and level of mastery of lecture material after completing the relevant section of the course.<br>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.<br>INDEPENDENT LEARNING<br>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.<br>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.<br>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 |
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| 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 |
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| Current assessment | 30 points | System tasks | 20 points (divided by the number | 18 points |

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| | | | | of tasks) | |
| | | | 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. S.R.Saydullayev “Kompyuter dasturi asosida muhandislik kommunikatsiya tizimlarini hisoblash” O'quv qo'llanma 2022 yil. JizPI

2. Boboev S, Shukurov G, Ismanhodjaeva M “Isitish”. Darslik. “Yangi asr avlodi” 2008 y, 298 b

3. U.T.Zokirov, E.S.Buriev “Aholiga ichimlik suv tayyorlash texnologiyasi” Darslik. 2013 yil. TAQI

4. U.M.Qutlimurodov. "Suv ta'minoti va oqova suvlarni oqizish tizimlari". Darslik. Toshkent-2021. T: Lesson press. 2021. 260 bet.

5. S.R.Saydullayev. "Issiqlik ta'minoti tizimlari (Issiqlik ta'minoti va issiqlik jarayonlari)". O'quv qo'llanma - 2021-Toshkent. 205 bet.

**Additional literatures**

6. Mirziyoyev Sh.M. 2019 — 2030-yillar davrida O‘zbekiston Respublikasining “yashil” iqtisodiyotga o‘tish strategiyasini tasdiqlash to‘g‘risidagi O‘zbekiston Respublikasi Prezidentining qarori, 04.10.2019 yildagi PQ-4477-son.

7. Mirziyoyev Sh.M. Tanqidiy tahlil, qat’iy tartib-intizom va shaxsiy javobgarlik – har bir rahbar faoliyatining kundalik qoidasi bo‘lishi kerak. O‘zbekiston Respublikasi Vazirlar Mahkamasining 2016 yil yakunlari va 2017 yil istiqbollariga bag‘ishlangan majlisidagi O‘zbekiston Respublikasi Prezidentining nutqi. //“Xalq so‘zi” gazetasi. 2017 y., 16 yanvar, №11.

8. O‘zbekiston Respublikasi Konstitutsiyasi. - T.: O‘zbekiston, 2017. - 46 b.

9. O‘zbekiston Respublkasini yanada rivojlantirish bo‘yicha Harakatlar strategiyasi to‘g‘risida. - T.:2017 yil 7 fevral, PF-4947-sonli Farmoni.

10. Tulakov, E.S. *Energy Efficiency Engineering of Buildings*. Study Guide. Samarkand State Institute of Architecture and Civil Engineering. Samarkand, 2020, 238 p.

11. McQuiston, F. C., Parker, J. D., Spitler, J. D. and Taherian H., Heating, Ventilating, and Air Conditioning: Analysis and Design; 7th Edition, John Wiley & Sons. ISBN 978-1-119-89414-8

12. Rashidov Yu.K., Koroli M.A. “Isitish” o‘quv qo‘llanma 2000 yil. 96b.

13. Tursunova U.X., Mamajonov T.M. «Issiqlik ta’minoti» o‘quv qo‘llanma, Toshkent, Talkin, 2004 y. 126 b.

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| | **Internet resources:**<br>1. www.ziyonet.uz – national educational materials search site.<br>2. www.gov.uz – Government portal of the Republic of Uzbekistan.<br>3. www.google.com – international educational materials search site.<br>4. www.energystrategy.ru – Information portal "Energy Policy and Strategy"<br>5. ww.twirpx.com – international educational materials search site. |

| № | Name of the Higher Education Institution (HEI) | QS | THE | Topic Title in This Programme | Additional Topics Introduced Based on Top 300 University Programmes | References: |
|---|---|---|---|---|---|---|
| 1 | **Norwegian University of Science and Technology (NTNU), Norway** (ranked 267th in the QS Top 300) – Faculty of Engineering, Department of Energy and Process Engineering (EPT), study programme in **Energy and Process Engineering**, course: **"Design of HVAC and Sanitary Systems."** | 267 | 303 | **Topic 1. Digital Design Tools.** | **Digital Design Tools.** Software tools used in the design of HVAC and sanitary systems. Calculation modules and graphical user interfaces. Project simulation. Methods for automating the design process and improving design accuracy. | https://www.ntnu.edu/studies/courses/MAST2310/2025/1#tab=omEmnet |
| 2 | **University of Maryland, USA** (ranked 157th in the QS Top 300) – study programme in **Heating, Ventilation and Air Conditioning Systems in Buildings**, course syllabus: **"Design of Heating, Ventilation and Air Conditioning Systems in Buildings."** | 157 | 207 | **Topic 2. Energy Calculations and Building Simulation.** | **Energy Calculations and Building Simulation.** Calculation of building energy requirements and their analysis through software-based modelling. | https://mage.umd.edu/sites/oaee.umd.edu/files/syllabi/ENPM625%202408%20Syllabus.pdf |