Name of subject	Energy-efficient automated electrical drives (ECTS 4)
Subject/module code	AEYU2405
Science taught semester (s).	4th semester
Responsible teacher	Kushakov Gulmurod Adilovich , Senior teacher.
Education language	Uzbek
Connection to the curriculum	Elective
Training hours (this including independent education)	**Total hours - 120** **Auditory training hours - 48** Lecture session hours - 24 Practical study hours - 24 **Independent education -72 hour**
ECTS	4
The purpose and tasks of subject / learning outcomes	**The goal of teaching the subject** is to develop in students the skills to analyze the structure of electromechanical systems, their elements, basic characteristics, and functions of electrical drives, the type of electromechanical system based on the requirements placed on them, its structural structure, and the shortcomings and operating principles of existing systems. **The task of science is** to provide students with theoretical knowledge, It consists in the formation of practical skills, a methodological approach to the physical processes occurring in high-voltage circuits, and a scientific worldview . It consists in the formation and development of operational thinking in industrial enterprises, training in the ability to clearly state one's opinions and conclusions in a well-founded manner, and the formation of the ability to apply them in practice. **Learning outcomes:** 1. Studies the regulatory documents of the higher education system and the organization of the educational process in the credit-module system 2. Study of technological higher education and interactive teaching methods 3. socio-economic reforms in our republic, regional problems, and achievements in science, technology, and engineering in the field of automation for industrial development; 4. working to release in automation main tasks ; 5. ***about*** the main stages of development of automation equipment and current trends ***to the imagination has to*** be ***;*** 6. automation in the field technician of tools structure principles and work principles ; 7. public automation technician of tools static , dynamic and reliability descriptions calculation methods ; 8. automation technician medium demand done classifications to form ; 9. technological of processes automation level increase for technician of tools instead assessment methods knowledge ***and from them use to receive;*** 10. automation technician tools static , dynamic and reliability descriptions to determine ; 11. demand done control , adjustment , management algorithms done increase can technician tools choice skills has to be ; 12. non-public automation systems tools for technician assignments to compile ;

	13. technician tools and their basis organization those who calculation and selection ; 14. When analyzing the operation of technical devices, their designers ***must have the skills to*** correctly determine their design parameters based on certain criteria. ***has to*** be ***necessary.***
Course content (topics)	**1. Home theoretical part (Lecture)** **Topic 1:** " Automated electromechanical systems " Introduction . Fanning purpose and objectives. General concepts . **Topic 2:** Automated electromechanical systems structure and main parts . **Topic 3:** Elements of electromechanical systems . **Topic 4:** Electromechanical couplings and their functions . **Topic 5:** AC motors . **Topic 6:** Immutable vine Engine torque and torque equations . **Lecture 7:** : Contactless circuit and work principle **Topic 8:** Asynchronous execution Connection diagrams and control methods of asynchronous execution engines . **Topic 9:** Basic devices of automated electromechanical systems . Synchronous motors **Topic 10:** C h linear motion engines **Topic 11:** Electromechanical systems measurement Elements . Selenium . **Topic 12:** Circulation transformers , their schemes , work principles . **Topic 13:** Tachogenerators . **Topic 14:** Open management schematic electricity Drives . Solid control schemes for electric drives . **Topic 15:** Control scheme of an electric drive with a synchronous motor. **II. Practical for training instructions and recommendations** Practical multimedia devices for training with equipped in the auditorium every one academic to the group separately will be passed. Trainings active and interactive methods using " Keystage " technology used , cases content teacher by is marked . Demonstrative materials and information multimedia devices using is transmitted . In addition , the textbook and training manuals based on students knowledge to strengthen reach , distribution from materials use , scientific articles and publishing theses through students knowledge increase , issues solution , topics according to demonstrative weapons preparation and others recommendation is being done . **Recommended practical topics** : 1. Determining the requirements for automated electromechanical systems. 2. Calculation of load torque and force in electromechanical systems. 3. Calculation of load capacity. Actuator mechanism . Construction of load diagram. Motor selection. Calculation of the gear ratio of the reducer. Checking the selected motor. 4. Selection of information elements of electromechanical systems. 5. Position , speed and torque sensors. 6. Calculation of parameters of the electric drive adjustment system. 7. of the parameters of the structural scheme of a DC motor . Construction of a static electromechanical characteristic.

	8. Calculation of speed adjustment contour parameters. **III. Independent study 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. Application of AEMS in mechatronic modules. 2. Principal alarm schemes design . 3. Using micromotors in robots sectors . 4. Electricity in supply backup and him/her automatic to work unloading 5. Electricity the procedure static and dynamic modes study . 6. Three phased transformers 7. Microprocessor complex elements . 8. C h linear motion engines calculation 9. Direct current linear motion motors study . 10. Synchronous linear motion motors study . 11. Multi-coordinate motors, their use in robots. 12. Imitative procedures use sectors . 13. AEMS sensors study . 14. Cable and of wires the ends to level assembly to do 15. Electricity the procedure management and protection to do
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 studied and carry out tasks in the current, intermediate forms of control and independent work, pass written work on the final control. 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. Yusupbekov N.R., Muxamedov B.I., Gulyamov Sh.M. Texnologik jarayonlarni nazorat qilish va avtomatlashtirish. - Toshkent: O`qituvchi, 2011. -576b.

2. N.K. Yo‘ldoshev, N.R. Kadirxodjayeva “Ishlab chiqarish texnologiyalari” Toshkent — 2014

3. John J. Criag Mechanics and Control -Pearson Education International, 2013

4. Клим Ю.М. Типовые элементы систем автоматического

управления. Учебное пособие для студентов учреждений среднего профессионального образования. -М: ФОРУМ : ИНФРА-М, 2004.-384с.

5. Москаленко В.В. Тизим автоматизированного управления электропривода» : -М.ИНФРА,2001. Шишмарев В.Ю. ТИПОВЫЕ элементы систем автоматичсского управления. Учебиик для сред.проф.образования. -М: Издат. «Академия», 2004 -304с.

6. Зимин Б.Н., Яковлев В.А. «Автоматическое управление электроприводами». М: высш.шк.1989г.

7. Башарин А.В. и др. «Управление электроприводами» Л: ВЫСШ.ШК 1982г.

8. Клюев В.И. и др. «Теория электропривода». - М: ВЫСШ.ШК 2002 г.

Additional literature:

9. Mirziyoyev Sh.M. Erkin va farovon, demokratik O‘zbekiston davlatini birgalikda barpo etamiz. O‘zbekiston Respublikasi Prezidentining lavozimiga kirishish tantanali marosimiga bag‘ishlangan Oliy Majlis palatalarining qo‘shma majlisidagi nutqi. – T.: “O‘zbekiston” NMIU. 2016. -56b.

10. O‘zbekiston Respublikasini yanada rivojlantirish bo‘yicha Harakatlar strategiyasi to‘g‘risida. – T.: 2017 yil 7 fevral, PF-4947 – sonli farmoni.

11.O.O. Xoshimov, SH.B. Umarov “Umumsanoat mexanizmlarining avtomatlashtirilgan elektr yuritmalari” Toshkent 2020.

12.Башарии А.В. «Примеры расчета автоматизированного электропривода на ЭВМ» Л:Машиностроение 1990 г.

13.Ломако М.В. «Микропроцессорное управление промышленных роботов» М:Машиностроение 1990 г.

14. Смирнова В.К. «Проектирование и расчет автоматизированных приводов» -М:Высш.шк 1990 г.

Internet sources:

17.www.lex.uz - National database of legal documents of the Republic of Uzbekistan.

18. www.ziyonet.uz - Education portal of the Republic of Uzbekistan.