Name of subject	Special electric machines (ECTS 4)
Subject/module code	MEM1704
Science taught semester (s).	7th semester
Responsible teacher	Saodullayev Abror Saypullayevich Senior teacher
Education language	Uzbek
Connection to the curriculum	Compulsory
Training hours (this including independent education)	**Total hours-120.** **Audience Training hours - 48.** Lecture training hour – 24 Laboratory training hour –12 Practical training hour – 12 **Independent education -72 hours**
ECTS	4
The purpose and tasks of subject / learning outcomes	**The purpose of teaching this subject.** The aim of the course is to teach students the structure and principles of operation of special electric machines, to form and develop the ability to select, operate, analyze the physical processes occurring in them, and calculate the energy efficiency of special electric machines, to teach them to clearly state their opinions and conclusions in a well-founded manner, and to develop the skills to apply them in practice. **The task of the subject** is to teach students the basic criteria for constructing switching circuits of special electric machines and determining their parameters, obtaining and analyzing the characteristics of special electric machines, evaluating various operating modes of special electric machines, controlling special electric machines and adjusting their speeds, and increasing the efficiency of special electric machines. **Learning outcomes:** 1.Special electric machines study the essence of special electric machine phenomena in nature and technology through the fundamental concepts of the science of special electric machines. 2.Study the theoretical foundations of the operating principle, physical properties and characteristics of special transformers. 3.Study the theoretical foundations, operating principle and characteristics of special alternating current machines. 4.Study the theoretical foundations, operating principle and characteristics of special direct current machines.
Course content (topics)	**I. Main theoretical part (Lecture)** **Topic 1:** Structure, operating principle and characteristics of frequency converters, welding and measuring transformers. **Topic 2:** Transformers that smoothly adjust voltage and change the number of phases. **Topic 3:** Transformers used in pulse techniques. Transformers that convert sinusoidal voltage signals into peak forms. **Topic 4:** Structure and principle of operation of an asynchronous generator. The principle of operation, structure and field of application of asynchronous tachogenerators. **Topic 5:** Induction voltage regulator operating principle and connection diagrams. Phase regulator operating principle structure and connection diagram. **Topic 6:** The structure and principle of operation of an asynchronous frequency converter. Information about asynchronous cascades. **Topic 7:** Structure, operating principles and characteristics of solid

rotor and linear induction motors.

Topic 8: Reactive synchronous motors and induction synchronous motors

Topic 9: Study the structure and operating principle of a hysteresis motor.

Topic 10: Study and improve theoretical knowledge of the structure and principle of operation of a stepper (impulse) motor. Structure, principle of operation and use of valve-inductor motors.

Topic 11: Study and improve theoretical knowledge of the structure and operating principles of permanent magnet synchronous machines. Study and improve theoretical knowledge of the structure and operating principles of hybrid excitation synchronous machines.

Topic 12: Structure, operating principles and characteristics of DC tachogenerators and contactless DC motors. Structure, operating principles and characteristics of actuator DC motors.

II. Instructions and recommendations for organizing laboratory exercises.

The department develops methodological instructions and recommendations for organizing laboratory exercises. In them, students will further enrich the knowledge and skills they have acquired on the topics of the main lectures and practical exercises by performing laboratory exercises and performing relevant calculations.

Suggested topics for laboratory work:

1.Conduct experiments with frequency-changing transformers and welding transformers.

2.Conduct experiments with phase-changing transformers.

3.Use an asynchronous machine in generator mode and obtain its characteristics.

4.Use an asynchronous machine as a frequency converter and study its characteristics.

5.Conduct experiments on reactive synchronous motors.

6.Conduct experiments on permanent magnet synchronous machines.

III. Instructions and recommendations for practical training

The department develops guidelines and recommendations for organizing practical classes. In them, students will further enrich their knowledge and skills on the main lecture topics through practical problems and cases. It is also recommended to consolidate students' knowledge based on textbooks and study guides, use handouts, increase students' knowledge by publishing scientific articles and theses, solve problems, prepare presentations and visual aids on topics, use regulatory and legal documents, etc.

Recommended practice topics:

1.Calculation of the voltage adjustment range of transformers.

2.Calculation of the parameters of peak transformers.

3.Calculation of the parameters of an asynchronous generator.

4.Calculation of the parameters of an asynchronous frequency converter.

5.Calculation of the parameters of a stepper (pulse) motor;

6.Calculation of the parameters of permanent magnet synchronous machines;

IV.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. **Independent study for the recommended topics:** 1.Relative unit system. 2.Reduction coefficients. 3.Starting a parallel-excited DC motor 4.Transition processes in electric machines with mutually displaced rotor axes. 5.Switching in commutator machines. 6.Construction of external and adjusting characteristics according to the Pote diagram. 7.Special power-saving asynchronous machines. 8.Special power-saving synchronous machines. 9.Special power-saving DC machines. 10.Special transformers. 11.Construction of angular characteristics of synchronous generators.
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.Donald V. Richardson. Rotating electric machinery and transformertechnology 1996, Prentice Hall.

2.M. E. El-Hawary. Princip les of Electric Machines with Power Electronic Applications. Wiley-IEEE Press. 2002.

3.A.S. Saodullayev, N.B. Pirmatov, A.E. Bekishev, N.A.Qurbonov Maxsus elektr mashinalari. Darslik. – T.: 2022 -231 b.

4.Berdiev U.T., Pirmatov N.B. Elektromexanika. Texnika oliy oquv yurtlarining «Elektr texnikasi, elektr mexanikasi va elektr texnologiyalari» va «Elektr energetika» yonalishi talabalari uchun darslik.– T.: Shams-Asa. 2014. –386 b.

5.Salimov J.S., Pirmatov N.B. Elektr mashinalari. Darslik.-T.: O'zbekiston faylasuflari milliy jamiyati nashriyoti, 2011. – 408 b.

6.Одилов Г. «Электр машиналарининг махсус курси»фанидфн мфъруздлфр мфтни.Тошкент.-1999. ТошДТУ.

7.G.N.Mustafakulova, O.Z. Toirov A.E. Bekishev "Maxsus elektr mexanik o'zgartgichlar". Toshkent. Yangi avlod-2009-322 b.

Additional literature:

8.Ўзбекистон Республикасини янада ривожлантириш бўйича

Ҳаракатлар стратегияси тўғрисида. – Т.:2017 йил 7 февраль, ПФ-4947-сонли Фармони.

9.Грищенко А. В. Новые электрические машины локомотивов. –М.: Изд-во.УМЦ ЖДТ, 2008-271 с.

10.Генделевич А.М. Электрооборудование воздушных судов. –Ульяновск.: УВАУ ГА, 2003.

11.Герасин А. А. Специальные электромеханические преобразователи автономных объектов. – М. Изд-во Машиностроение, 2012.-250 с.

12.Хитерер М. Я., Овчинников И. Е. Синхронные электрические машины возвратно-поступательного движения. – СПБ.: КОРОНА принт, 2008.-388 с.

Internet resources:

13.www.ziyonet.uz

14.http://dhes.ime.mrsu.ru/studies/tot/tot_lit.htm;

15 http://rbip.bookchamber.ru/description.aspx?product_no=854;

16.http://energy-mgn.nm.ru/progr36.htm