Name of subject	Fundamentals of electrical mechanics (ECTS 6)
Subject/module code	EMA 2505
Science taught semester (s).	5th semester
Responsible teacher	Saodullayev Abror Saypullayevich
Education language	Uzbek
Study to the program connection	Selection
Training hours (this including independent education)	**Total hours-180.** **Audience Training hours - 72.** Lecture training hour – 24 Laboratory training hour –0 Practical training hour – 48 **Independent education -108 hours**
ECTS	12
The purpose and tasks of subject / learning outcomes	**The purpose of teaching this subject:** To provide the level of modern knowledge, skills, and experience required by the educational standard, consistent with the profile of the direction in the fundamentals of electromechanics. **The task of the subject** is to teach students the basics of electromechanical theory, the types and structure of electromechanical converters, and the electromagnetic processes occurring in them. To achieve this goal, the subject performs the tasks of providing students with theoretical knowledge, practical skills, problem-solving skills, principles of their work and a methodological approach to work processes, and the formation of a scientific worldview. **Learning outcomes:** 1.Electrical mechanics studies the essence of electromechanical phenomena in nature and technology through the fundamental concepts of the science of the foundations of electrical mechanics. 2.Studies the theoretical foundations of the operating principle, structure, and physical properties and characteristics of transformers. 3.Studies the theoretical foundations, structure, and operating principle of alternating current machines. 4.Studies the theoretical foundations, structure, and operating principle of direct current machines.
Course content (topics)	**I. Main theoretical part (Lecture)** **Topic 1:** Balance of energy types. Mechanical energy. Electrical energy. Thermal energy. Energy of a system with a current-carrying conductor. **Topic 2:** Expression of force in terms of energy change. Forces and moments between circuits with changing mutual inductance. **Topic 3:** Electromotive forces of an electromechanical system. Physical model of electromechanical converters. **Topic 4:** Magnetic field in air. Coil function. Flux conductivity and inductance of a coil. Magnetic fields generated by coils. **Topic 5:** Dependence of the field in an air gap on the voltage drop. **Topic 6:** Vudson and Uayt model of an electric machine. **Topic 7:** Structure and principle of operation of a polyphase asynchronous machine. Electrical diagram. **Topic 8:** Structure and operating principle of a polyphase synchronous machine. Electrical diagram. **Topic 9:** The structure and principle of operation of a DC electric machine. Electrical diagram. **Topic 10:** Equivalent electrical circuits of electromechanical

converters. Study and analysis of the polarity of coils.

Topic 11: Heating of electromechanical converters. Ways to cool it.

Topic 12: Familiarization and analysis of the main nominal operating modes of electric machines.

II. 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.Types of energy in electromechanics and their balance.

2.Laws of electrical circuits. Parameters of electrical circuits.

3.Energy of a system with a current-carrying fixed conductor in electromechanics.

4.Expression of force in electromechanics through energy changes.

5.Calculation of forces and moments between contours.

6.Calculation of electromotive forces of an electromechanical system.

7.Calculation of the coil function. Analysis of coil parameters.

8.Analysis of the torque of an idealized machine.

9.Study of magnetic fields generated by electric machine coils.

10.Calculation of the electromotive force of a coil.

11.Dependence of the field in an air gap on coil forces

12.Analysis of the main types of electric machines.

13.Calculation of parameters of direct current motors

14.Drawing up equivalent electrical diagrams of electromechanical converters.

15.Determining the polarity of windings.

16.Calculation of parameters of equivalent electrical diagrams of transformers.

17.Methods for calculating the heating of electromechanical converters

18.Development of recommendations for checking the main nominal operating modes of electric machines.

19.Study of parameters and characteristics of asynchronous motors

20.Methods for eliminating malfunctions in asynchronous motors

21.Calculation of parameters of synchronous machines with superconducting windings.

22.Study of some malfunctions occurring in synchronous machines and ways to eliminate them.

23.Calculation of parameters of synchronous motors.

24.Analysis of factors causing malfunctions in power transformers.

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.

	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.
Student assessment	Assessment of student knowledge is based on the mastery of the teaching material during the semester and final control (tests, assignments, written and oral work results). During the course of Fundamentals of electrical mechanics, students are evaluated on a 100-point system. Of these, 50 points are allocated to the current and intermediate results (60% of the 50 points are current control, independent study and 40% are intermediate control), and 50 points are allocated to the final control results. Students whose total score of current and intermediate points is less than 30 points are not admitted to the final control exam. A student who scores 30 or more points in the final control is considered to have mastered the subject.
Requirements for exams	The student must have fully mastered the theoretical and practical concepts of the subject, be able to correctly reflect the results of the analysis. The student must have completed the tasks given in the current and intermediate forms of independent work, assessment. At the same time, he must have received the necessary points from the current, intermediate, independent education and final tests in the relevant subject within the specified time. A student who has not submitted current control, intermediate control and independent education tasks, as well as who has scored less than 30 points on these tasks and types of control, will not be included in the final type of control. Also, a student who has missed 25 or more percent of the classroom hours allocated to the subject without an excuse will be expelled from this subject, will not be allowed to take the final exam and will be considered as not having mastered the relevant credits in this subject. A student who fails the final exam or scores less than 30 points on this type of exam is considered academically indebted.
Recommended Literature	**Main literature:** 1.Bhattachrya. Electrical machinees 3E book. 2008, N/A p. 2.Fitzgerald. Electric machinery, 6/E book. 2002, N/A p. 3.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. 4.Pirmatov N.B. Zaynieva O.E. “Elekromexanika asoslari”. O‘quv qo‘llanma. -T.: “Ma’naviyat”, 2015. – 104 b. 5.Salimov J.S., Pirmatov N.B. Elektr mashinalari. Darslik.-T.: O’zbekiston faylasuflari milliy jamiyati nashriyoti, 2011. – 408 b. 6.Иброҳимов У. Электр машиналари. Ўқув қўлланма. – Т.:Ўқитувчи, 2001.

7.Мажидов С. Электр машиналари ва электр юритма. Ўқув қўлланма. –Т.: Ўқи¬тувчи, “Зиё-Ношир” КШК, 2002. – 408 б.

Additional literature:

8.Мирзиёев Ш.М. Буюк келажагимизни мард ва олижаноб халқимиз билан бирга қурамиз. - Т.: “Ўзбекистон” НМИУ, 2017. – 488 б.

9.N.B. Pirmatov, Z.A. Yarmuxamedova, G.N. Mustafakulova. Elektr mashinalari fanining transformatorlar qismi bo‘yicha kurs loyihasini bajarishga oid o‘quv-metodik qo‘llanma. –T.: ToshDTU, 2012 – 117 b.

10.Кацман М.М. Сборник задач по электрическим машинам. Учеб. пособие для вузов. –Москва.: – Издательский центр «Академия». 2012. –154 с.

11.Мустафакулова Г.Н., Тошов Ш.Э. Электр машиналари фанидан лаборатория машғулотларини бажариш учун методик кўрсатма. –Т.: ТДТУ, 2015. – 45 б .

12.Пирматов Н.Б., Зайниева О.Э. Электромеханика (Электр машиналари) фанидан масалалар тўплами. Ўқув қўлланма. –Т.: ТДТУ, 2004. – 75 б.

Internet resources:

13.www.mygov.uz – Government portal of the Republic of Uzbekistan.

14.www.catback.ru – International website for scientific articles and materials.

15.www.google.com – International educational materials search site.

16.www.ziyonet.uz – national educational materials search site.