



MIRZO ULUG'BEK NOMIDAGI  
O'ZBEKISTON MILLIY UNIVERSITETINING  
JIZZAX FILIALI

**ZAMONAVIY INNOVATSION  
TADQIQOTLARNING  
DOLZARB MUAMMOLARI  
VA RIVOJLANISH  
TENDENSIYALARI:  
YECHIMLAR VA ISTIQBOLLAR  
RESPUBLIKA ILMIY-TEXNIK  
ANJUMAN MATERIALLARI  
TO'PLAMI**



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**O‘ZBEKISTON RESPUBLIKASI OLIY TA’LIM, FAN VA  
INNOVATSIYALAR VAZIRLIGI**

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MUAMMOLARI VA RIVOJLANISH TENDENSIYALARI: YECHIMLAR  
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## **SOFTWARE AND METHODOLOGICAL SUPPORT FOR DEVELOPING AUTOMATION-RELATED PROFESSIONAL COMPETENCIES OF FUTURE ELECTRICAL ENGINEERS**

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**Annotation:** This thesis discusses the software and methodological support for developing automation-related professional competencies of future electrical engineers. The study analyzes the pedagogical possibilities of using modern digital technologies in teaching the course “Electric Machines” including PLC programming, TIA Portal, MATLAB Simulink, SCADA systems, and virtual laboratories. The paper also considers the formation of students’ practical skills through modeling and automated control of electric machines. Based on a competency-oriented approach, the integration of interactive teaching methods and software tools is substantiated as an effective means of improving the professional training of electrical engineering students. The obtained results are important for enhancing the teaching methodology of the “Electric Machines” course in higher educational institutions through modern educational technologies.

**Keywords:** professional competence, automation, electric machines, pedagogical technologies, digital simulation, PLC programming, interactive learning, virtual laboratory, competency-based approach, software and methodological support.

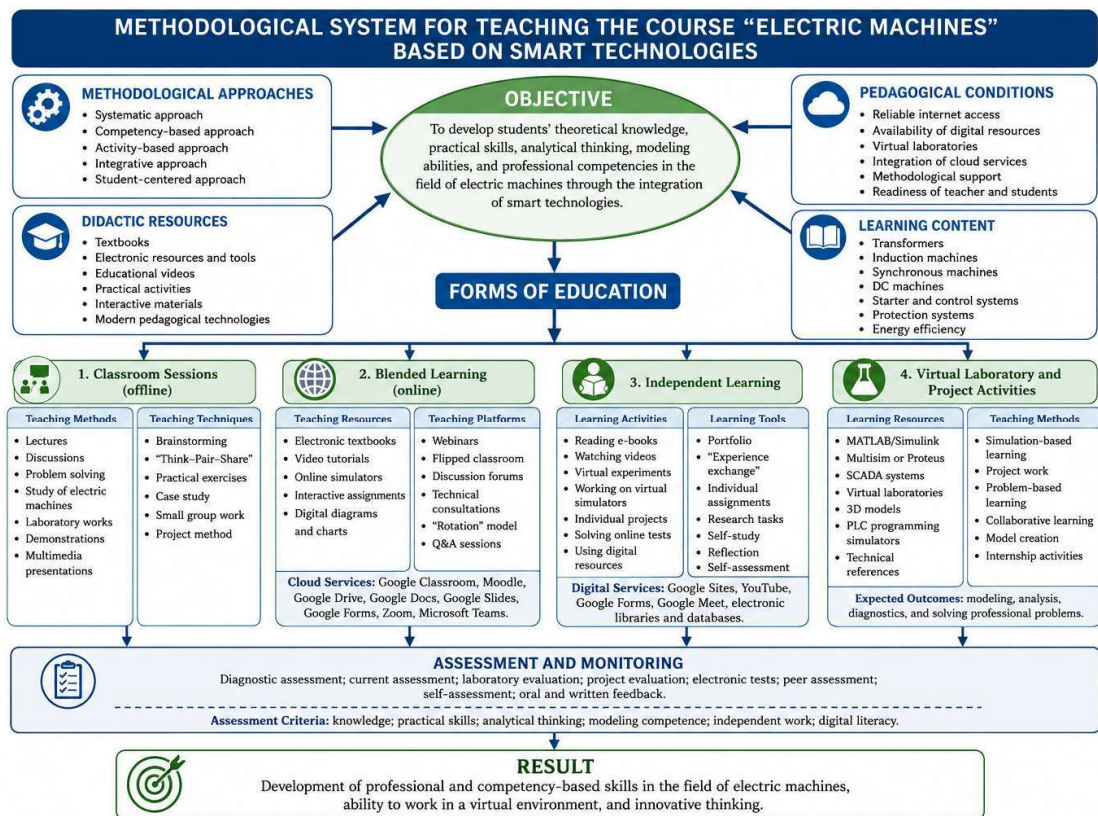
Today, the automation of production processes in industrial enterprises, the introduction of energy-efficient technologies, and the use of digital automatic control systems are considered among the most important issues. Therefore, training future

electrical engineers on the basis of modern automation technologies has become highly significant in higher education institutions. In particular, the use of software tools such as PLC, SCADA, TIA Portal, MATLAB Simulink, and Ansys Maxwell in teaching the course “Electric Machines” provides effective results in developing students’ professional competencies [1].

Professional competence is defined as the ability of a student to apply theoretical knowledge in practical activities, analyze technological processes, solve problems independently, and effectively use modern technical tools. In the process of training future electrical engineers, the development of automation-related competencies is directly connected with the requirements of modern industry. The main objective of software and methodological support in teaching the course “Electric Machines” is not only to provide theoretical knowledge, but also to teach students how to work with practical control systems [4]. In traditional classes, students study the structure, operating principles, working modes, and fundamentals of electric drives of transformers, induction machines, synchronous machines, and DC machines [2]. However, modern industrial production requires these electric machines to be integrated with automatic control, remote monitoring, and protection systems. From this perspective, the following software tools are considered appropriate for teaching the course “Electric Machines” [5]:

- **TIA Portal** – for PLC programming and automatic motor control;
- **MATLAB Simulink** – for mathematical modeling and simulation of electric machines;
- **Ansys Maxwell** – for the design and analysis of electric machines;
- **SCADA systems** – for automatic control and monitoring of electric machines.

For example, during laboratory sessions on controlling an induction motor through a PLC, students learn to work with contactors, relays, and frequency converters. In the TIA Portal environment, a “Start-Stop” control program is created using a LAD diagram. As a result, students acquire practical skills in the automatic control of electric drives. Real laboratories and digital simulations also play an important role in developing professional competencies. Through simulation technologies, students gain opportunities to design and model complex industrial processes in a safe virtual environment. This contributes to a deeper understanding of the operating principles of electrical equipment and enhances practical learning outcomes [5].



**Figure 1. Methodological System for Teaching the “Electric Machines” Course Based on Cloud Technologies**

Integrating automation elements into the subject of Electrical Machines helps prepare students for real technological processes in industrial enterprises. In particular, processes such as motor protection, starting, reverse control, and speed regulation via frequency control develop students’ technical thinking when implemented through software-based control systems. In today’s “Industry 4.0” environment, an electrical engineer is required not only to understand electrical machines, but also to integrate them with digital automated control systems. Therefore, strengthening interdisciplinary integration in higher education is of great importance [6]. Coordinated teaching of the subjects “Electrical Machines”, “Theory of Automatic Control”, and “Basics of Electric Drives” improves the quality of professional training. In the development of automation-related professional competencies of future electrical engineers, software-methodological support serves as an important pedagogical tool. Teaching the subject “Electrical Machines” based on modern software platforms and digital simulations strengthens students’ theoretical knowledge and develops their practical skills. In addition, the use of PLC programming, real laboratories, SCADA systems, and electrical machine design technologies enables students to become specialists who meet modern industrial requirements. As a result, students develop competencies in independent thinking, solving technical problems, and working with automated systems. In the future, the wide implementation of digital technologies, artificial intelligence, and intelligent control systems into the educational process will be of great importance in the training of electrical engineers.

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## TA’LIMDA RAQAMLI INQILOB VA YANGI RENESANS.

**Axmedova Shoxida Muxtarovna**

**Xaydarova Shaxzoda Xayrullayevna**

Jizzax davlat pedagogika universiteti

**Annotatsiya:** Mazkur maqolamda ta’lim tizimidagi raqamli inqilob jarayonlari hamda Yangi Renessans g‘oyalari asosida shakllanayotgan zamonaviy pedagogickyondashuvlar tahlil qilinadi. Raqamli texnologiyalar, sun’iy intellekt va interaktiv ta’lim vositalarining o‘quv jarayoniga integratsiyasi, shuningdek, pedagogik tafakkurning transformatsiyasi ilmiy jihatdan yoritiladi.

**Kalit so‘zlar:** Ta’lim, raqamli inqilob, Yangi Renessans, pedagogik tafakkur, raqamli texnologiyalar, sun’iy intellekt, innovatsion ta’lim, interaktiv platformalar, masofaviy ta’lim, zamonaviy pedagogika.

So‘nggi yillarda globallashuv va texnologik taraqqiyot inson hayotining barcha jabhalariga, xususan ta’lim tizimiga ham chuqur ta’sir ko‘rsatmoqda. Raqamli inqilob deb nom olgan bu jarayon bilim olish, o‘qitish va o‘rganish tamoyillarini tubdan