The European Proceedings of
Social and Behavioural Sciences
EpSBS

www.europeanproceedings.com
e-ISSN: 2357-1330

DOI: 10.15405/epsbs.2024.10.26

SCTMG 2023
International Scientific Conference «Social and Cultural Transformations in the Context of Modern Globalism»

ELECTRICAL ENGINEERING AND ELECTRONICS DISCIPLINE ROLE IN THE ACQUISITION OF CADETS KNOWLEDGE

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Abstract

New views on engineering education, which consist in the purposeful development of creative potential of a future specialist, make it necessary to search for ways to modernise higher technical education by introducing information technologies in the process of student learning. The article considers the processes of the training of specialists in the application of on-board complexes of sea and air vessels, information support of educational activity, formation of new approaches to training with the use of new information and communication technologies, including network technologies. The formation of the process of teaching electrical engineering disciplines in a technical university today is possible due to the development of problem-activity learning technologies. The work shows that electrical engineering and electronics, according to leading experts, are developing at a faster pace than other branches of science and technology. Therefore, cadets' mastery of the principles and methods of analysis, ideas about the functionality of analog and digital circuitry, allow them to move on to studying more complex issues in special disciplines of operation and application of ship systems for various purposes.

Keywords: Electrical and electronics engineering, information technology, safety, training

https://doi.org/10.15405/epsbs.2024.10.26
Corresponding Author: Valentin Shkoda
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

1. Introduction

Modern education of Russian specialists is undergoing cardinal changes. It is connected with the change in the strategic orientation of higher education, its goals. Therefore, there are new requirements to the education of specialists taking into account the developing electronic and information systems, communications, resources, which can be defined as innovative education. The basic provision of the innovative component of the modernisation of the educational process is the expansion of content and methods for a more complete mastering of the knowledge system (Mele, 2022; Nikulin, 2023; Rawel, 2022).

2. Problem Statement

A characteristic feature of current scientific cognition is the activation of students' attention to the comprehensive links between sciences, as well as the fact that it is possible to study a phenomenon of reality in depth only by examining it from different positions. The challenges of integration processes lead to the need to move from the study of particular aspects of fundamental knowledge to the acquisition of knowledge brought into a unified system. Each science underlying general education and professional courses of Bachelor's training investigates a certain element of the surrounding reality with the help of worked-out techniques and methods. However, everything in nature is interconnected, so knowledge about it should not be fragmentary and disjointed (Collet-Sabé, 2023; Manakbayeva, 2023; Sheveleva, 2024).

General professional disciplines play an important role in this training. They involve consideration of technical aspects of application of physical phenomena, laws, theories. The laws of nature, studied by physics, are used in the development of technical instruments, devices and machines and the study of technological processes. Physics provides technical sciences with its research methods.

The connection between the elements is realised through the previous studied disciplines and subsequent disciplines of the special cycle. The interaction of elements with each other is realised through the commonality of concepts, laws, theories and research methods of related disciplines. This makes it possible to create conditions for continuity in the educational process, contributes to deepening and improving the quality of knowledge on the basis of the implementation of interdisciplinary links.

The methodological significance of the use of physics discoveries in technical sciences lies in the general principles of physics, promoting the unity of physical and technical cognition of the surrounding reality, increasing the theoretical level of applied research (Giza, 2024; Mambetova et al., 2024; Mascareno & Chavez, 2024).

The specifics of working programmes development are aimed at mastering the basic disciplines, their logical continuation, building and transformation of educational material for the profile areas of training. Therefore, interrelationships with the disciplines of the professional cycle are established

The main direction of modern education is the development of independent thinking and the ability to self-education as a basis for continuous professional growth. Teaching electrical engineering in educational institutions of our country has a history of more than 250 years. Nevertheless, it was formed as an independent discipline only by the end of the XIX century. Laying the foundation of electrical

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engineering and the formation of its scientific basis, in the late XVIII – early XIX centuries, were the beginning of comprehension of electrical phenomena for teaching purposes (Borodina et al., 2021; Kondratiev et al., 2019; Uglova, 2016).

"Electrical engineering and electronics" is one of the most important disciplines of the engineering cycle. Electrical engineering is a field of science and technology that studies electrical and magnetic phenomena and their use for practical purposes. Electronics studies the nature of interaction of electrons with electromagnetic fields and methods of creating electronic devices for the conversion of electromagnetic energy. Without electronics, it is impossible to build modern devices in any field of engineering. It is the development of electrical engineering and electronic technologies that is responsible for modern progress.

The short course of lectures on the discipline "Electrical Engineering and Electronics" is designed for students of technical training. It contains theoretical material on the basic issues of electrical engineering and electronics, principles of construction of analogue and discrete devices.

The course is aimed at the formation of students' knowledge of the basic laws of construction of electrical and electronic devices, the application of this knowledge to understand the processes occurring during the operation of electrical and electronic equipment, its correct operation.

The discipline "Electrical Engineering and Electronics", forming an integral personality, prepares it to determine the essential meanings of professional activity, contribute to the development of personality qualities at all levels of competence approach implementation: instrumental, communicative, systemic (Ivanov et al., 2022).

To successfully master the discipline "Electrical Engineering and Electronics", the student must know the basic fundamental physical theories of classical mechanics, molecular-kinetic theory, thermodynamics, classical electrodynamics, special theory of relativity, optics, elements of quantum theory.

As is well known, electrification has played a decisive role in the scientific and technological progress of mankind. Currently, there is no sphere of human activity, branch of science and technology where electricity is not used, starting from rocket and space technology and ending with everyday life. Indeed, nowadays it is difficult to imagine one's life without numerous gadgets, electronic payments, electrical equipment and the Internet (Gorbunova et al., 2018; Ivanov et al., 2022).

The teacher's use of innovative means of teaching, i.e. the use of new knowledge, methodological approaches, technologies is positively evaluated by students, disciplines them, involving computers and other technical means. Informatisation of the educational process is perceived by cadets as the most progressive means of communication, and this is expressed in an active, democratic contact "teacher – cadet".

3. Research Questions

Educational objectives of the discipline are development of ideas about the basic regularities in electric circuits of direct and alternating current with linear and non-linear elements, features of three-phase current; study of devices, principle of operation and use of electric machines of direct current, synchronous machines, asynchronous motors and transformers. They also include obtaining skills to work

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with electrical measuring and control devices, sensors; development of ideas about modern electronics and microelectronics, the main base of modern electronics and microelectronics.

4. Purpose of the Study

Hence, with the existing possibilities of informatisation of education, we can talk about asynchronous communication between the cadet and the teacher, in particular, through electronic educational resources. So the most important task is to create such system which will provide conditions for the dynamic development of future specialists in the field of operation of modern shipboard and radio-electronic equipment

5. Research Methods

Hence, there are several interrelated directions to address this challenge:

i. improving the quality of education through fundamentalisation, application of new approaches in teaching with using new information and communication technologies, including network technologies;
ii. ensuring that the development of the education information system is ahead of the curve;
iii. ensuring greater accessibility of education through the use of distance learning technologies (Molochkov, 2016).

Any qualified engineer must know the laws of electrical signal propagation, how to obtain an electrical signal, the basic methods of analysing electrical circuits and the devices that make them up. Consequently, the study of electrical engineering enables engineers to proficiently solve the problems they encounter everywhere, since:

i. without electricity, it is impossible to run an urban economy and support people's livelihoods;
ii. without electricity, virtually no production is possible;
iii. without knowledge of the basics of electrical engineering, it is impossible to study the nature of the Earth and near-Earth space;
iv. without electricity, modern communication systems cannot operate;
v. without electricity, land and air transport cannot function.

In the process of the training of specialists of on-board complexes, the issues of ensuring high quality of training on the basis of advanced educational technologies are topical. Reflecting the needs of social production in qualified specialists, advanced higher education satisfies these needs.

In this system, the main attention should be focused on the development of abilities to act independently in conditions of uncertainty. The same should be developed with the ability to learn, to acquire new knowledge in the cycle of general professional disciplines, skills of mastering modern methods of obtaining, accumulating, classifying these knowledge (Vilensky et al., 2004).

The study of the discipline involves lectures, practical classes, laboratory, calculation and graphic works. The main link of the educational process is lectures, which are most significant, difficult to grasp or insufficiently covered in the educational literature.

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The modelling of professional activity in the educational process is implemented when it is possible to simulate the corresponding production situation not only mentally, but also having proper equipment in the form of simulators and selection of necessary sets of normative documentation for everyone working individually or in a small group.

"Electrical and electronic engineering" provides fundamental knowledge of the profession. Laboratory and practical classes belong to the applied side of vocational training. They can be considered as a basic module that allows simulating professional activities in the teaching process (Skvortsov, 2017).

Simulation modelling of professional activity acquires a special meaning, if laboratory and practical work is carried out not only with the study of real circuits and devices, but also with the help of special computer programs.

Laboratory works and practical classes are provided for a deeper consolidation of theoretical knowledge, imparting the necessary practical skills of working with measuring instruments (Gorbunova et al., 2018).

The integrative approach of the concrete-scientific level considers education as a process and a result of a pedagogical integration. Electrical engineering as a general technical discipline has an integrative basis in structure and content. Its study will be more effective if didactic conditions of interdisciplinary links are used, and, first of all, with physics, which is the scientific foundation of electrical engineering.

Therefore, the discipline prepares students to solve many problems. These are mastering the techniques and methods of solving specific problems from modern fields of electrical engineering; studying the physical essence of the processes occurring in electrical and magnetic circuits, elements of electronic devices. There is also studying the device and principles of DC and AC machines; familiarisation with modern scientific equipment, formation of skills to conduct electrical experiments (Epikhin et al., 2021; Vilensky et al., 2004).

A significant part of the study time in the implementation of the educational programme in the profile "Flight operation and application of aviation complexes" is devoted to the acquisition of fundamental knowledge (in natural and mathematical disciplines).

However, based on the principles of advanced education, we believe that the most important condition for the effectiveness of education is the need for its connection with the latest research and development in the field of electrical engineering and electronics (Balyaeva, 2021; Borodina et al., 2021; Kondratiev et al., 2019).

6. Findings

"Electrical engineering and electronics", according to leading specialists, are developed at an advanced pace in comparison with other branches of science and technology. So the mastering of principles and methods of analysis by cadets, the idea of functional capabilities of analogue and digital circuitry, allow one to proceed to the study of more complex issues in special disciplines of operation and application of ship complexes of various purposes (Alekhin, 2014; Gritsanov et al., 2003; Sverchkov, 2009; Uglova, 2016).

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It is important to highlight the methodical, practice-oriented orientation of the training material when considering the physical basis of the functioning of the element base and nodes of analogue and digital circuitry. It should also be noted that this material covers a set of problems related to the design, research and operation of marine and aircraft.

Formation of electrical knowledge, basic scientific and technical concepts, theoretical methods of research should be carried out in laboratory and practical classes with the implementation of interdisciplinary links in the theoretical and methodological aspects. Without a system-wide approach to higher education, engineering thinking and vision in practice will not yield the expected results. And additionally, great moral and material costs will be required to bring the future technical specialist to the qualified level of training required by the modern employer.

7. Conclusion

Theoretical prerequisites for designing the system based on the idea of strengthening the fundamental electrical training and professional orientation of the content of the main course and the special course in electrical engineering were:

i. theoretical bases for building a system of fundamental and electrical engineering disciplines in professional and pedagogical education;
ii. educational opportunities of humanities disciplines, in the process of which professionally significant personal qualities of future specialists are formed;
iii. career guidance problems in the aspect of their influence on the formation of life plans of future masters of vocational training, technicians (Khudyakova, 2006).

The increasing speed of change of knowledge-intensive technologies in the field of electrical engineering brings to the forefront the need to implement training in electrical engineering disciplines. Their meaning is not so much in the transfer of knowledge, but rather in the training of graduates of technical universities with a predominant focus on the development of high professional competence (Alekhin, 2014; Blinov et al., 2004; Bhuyan & Chatterjee, 2009; Panfilov et al., 2004; Sverchkov, 2009). Becoming the process of teaching electrical engineering disciplines in a technical university today is possible due to the development of problem-activity teaching technologies.

This, in turn, presupposes a sufficiently complete mastery of modelling methods, the ability to apply relevant knowledge and skills when working with remote information resources, to possess information-network culture, to be able to use the Internet to globalise information resources.

As a basis for information-technology modelling, mastering the basic principles of operation of shipboard and radio-electronic equipment for various purposes (power engineering, on-board computer complexes, various switching processes and apparatuses, communication and navigation devices), cadets should know the basic laws and rules of electric and magnetic circuits. These involve the basics of semiconductor and digital electronics, being able to analyse and apply them to form the professional competences of specialists in the operation and application of radio-electronic equipment (power engineering, on-board computer complexes, various switching processes and apparatuses, communication and navigation devices).

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