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Research Article

TOPICAL ISSUES OF TEACHING ELECTRICAL DISCIPLINES IN HIGHER EDUCATIONAL INSTITUTIONS

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ABSTRACT

The article deals with modern problems in the teaching of electrical disciplines, in the conditions of a credit-modular system of higher education. In particular, topical issues of education, the unity of theoretical knowledge and practical skills, have been studied. On the basis of statistical research, and in order to ensure the unity of theory and practice, methods for organizing practical classes in electrical engineering are proposed, based on the practical applications of the material being studied.

KEYWORDS

Electrical disciplines, higher educational, credit-modular system.

INTRODUCTION

One of the priorities in the development of higher education is the formation of practical skills for future specialists and the ability to apply their theoretical knowledge in practice. The solution of these issues, of course, is related to the solution of specific economic, social, organizational and methodological issues in the organization of education. The article discusses some of the tasks in the formation of practical skills among students, in the process of transferring higher education to a credit-modular system. Features of the formation of practical skills are considered on the

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example of teaching the subject "Fundamentals of Electrical Engineering and Electronics".

Problem Statement and Problem State

Despite the fact that in recent years much attention has been paid to such issues as ensuring the unity of education and production, it is too early to say that certain results have been achieved. Naturally, this is due to the great inertia of the education process (revision of curricula, preparation of textbooks and other issues of preparation of educational, methodological and regulatory documents for the entire level of lifelong education). Most importantly, the learning outcomes depend on the quality of the organization of the educational process (both classroom studies and student self-study) and the level of practical significance of the material being taught. The latter also requires a review of all training material and make appropriate additions to the practical application of the trained material. At the same time, the considered practical examples should be taken directly from production, for example: technological equipment, or their individual parts; machines and mechanisms; widely used electrical means of the production process; household electrical appliances and devices and others. It is also important to indicate the brands of all considered specific devices, machines, equipment and their individual parts. This directs the student to independent work on this issue: searching the Internet for the indicated device; study of its technical characteristics; independently verify the practicality of the material being studied; search for alternative ways to solve the problem. As a result, the questions under consideration become practical, accessible and interesting for the student, which is very important for improving the quality of education.

It should be noted that the structure of curricula for specialties in undergraduate education systems (including the system of higher education in Uzbekistan) is somewhat complicated, which ensures that these plans comply with modern requirements and norms of international standards. At the same time, the process of transition of higher education to economic independence provides opportunities for adapting educational programs to the requirements of consumers. At the same time, the main place, of course, is occupied by the economic aspects of education, especially the adaptation of the educational process to the credit-modular system. For example, with the transition to a credit-modular education system, the ratio of classroom and independent hours of the educational process changes significantly and becomes approximately 40/60. This means if, according to the curriculum of the specialty, 120 hours are allocated for the subject, of which 48 hours are in the classroom, 72 hours of self-study. It is in this position that the subject “Electrical Engineering and Fundamentals of Electronics” is located on the example of the Tashkent Institute of Chemical Technology. Undoubtedly, this requires a significant revision of the teaching materials, in terms of their distribution in the classroom and self-study. Since, one of the basic principles of credit-modular education is to reduce the number of classroom hours. Therefore, the next task arises, providing the subject with textbooks and teaching aids for all types of classes (laboratory, practical, independent), taking into account the above changes. It is also necessary to radically change the methods of teaching classroom lessons (lectures, laboratory and practical classes). At the same time, the main goal of classroom studies should be aimed not only at transferring theoretical knowledge, but also at demonstrating their practical application with concrete examples. Only then, the student will develop the skills necessary for practice in each subject. Otherwise, the received theoretical knowledge is only informational in nature, and is quickly forgotten. It is

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for this reason that we have a relatively low level of residual knowledge among students in almost all subjects taught. Hence the separation of learning from practice.

Electrical engineering, especially the practical problems of electrical engineering, is closely related to the electromagnetism section of the physics course. Practical classes in physics and electrical engineering have in many ways a common theory and methodology. At the same time, the essence of practical classes, both in physics and in electrical engineering, is aimed at solving problems. From the point of view of the formation of practical skills, the choice of appropriate tasks that have direct practical application and the method of setting this task is important.

As is known, for many decades, the main textbook for practical classes in physics has been the textbook by V.S. Volkenshtein "Collection of problems in the general course of physics". one-sided approach to tasks in the textbook, today the essence of practical training in physics has turned to the performance of arithmetic operations. It should be noted that the situation is similar with other textbooks.

Consider problem 10.25 in the textbook [1], " Element with emf. E \u003d 6V gives the maximum current I \u003d 3 A. Find the largest amount of heat Q that can be released in the external resistance per unit time. It does not specify source and consumer types. The only thing that is meant is the allocated amount of heat on the external resistance per unit time. Also, the consumer type is not considered. The purpose of the task is aimed at training power, from the point of view of physics.

With such a formulation of the question, at first glance, the practical significance of the task is not visible, or at least the student does not catch this moment on his own. It is for this reason that the student is not interested in such problems containing only theoretical concepts and arithmetic operations. Even if the student fully masters the essence of this task, it is quickly forgotten, since it has no practical application. Although the goal of this task is to lead the student to the practical application of electrical parameters, this goal is not achieved here. Therefore, it is advisable to introduce into the condition of this problem such parameters of the current source that are of direct practical importance. This is the current capacitance of the source, physically it is the amount of charge accumulated in the source q = I • t (Cl = A • s). In practice, it is usually used in the form A h (Ampere hour). Despite the fact that this parameter is indicated on all chemical current sources, it still remains unnoticed. And the reason for this is that, as mentioned above, physical quantities are studied only from a theoretical point of view, and not from its non-practical applications. As a result, these physical parameters are forgotten very quickly, without leaving a trace, or, as they say, "residual knowledge".

RESEARCH QUESTION STATISTICS

Table-1 shows the results of a survey conducted among 2nd-year undergraduate students in different areas of study, before the start of training in the subject "Electrical Engineering and Fundamentals of Electronics".

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Table 1

	Questions	The total number of respondents	positive responses regarding total number of respondents in %
1. 2.	How much energy is converted into electricity in batteries?	543	32
3.	Do you know what is the working voltage of your phone	350	14
4.	What is battery capacity and how is it measured?	326	9.5
5.	How can you determine how much energy is stored in your phone battery	528	2.6

The results indicated in the table indicate that the teaching of the subject "Electrical Engineering and Fundamentals of Electronics" should begin precisely with the study of the basic electrical parameters that are directly related to electrical energy.

Now consider the following example, typical for practical problems, both in electrical engineering and in the section of electricity in physics. Usually, the electrical circuit and the physical parameters of the circuit are given in the tasks. It is required to determine some unknown circuit parameters. It also does not talk about the practical application of this scheme (what kind of consumers, what kind of source and its parameters). The formulation of the problem in such a classical form is given in Table 2 (option-1). With such a formulation of the problem, a positive result is from 45 to 65%.

Table 2

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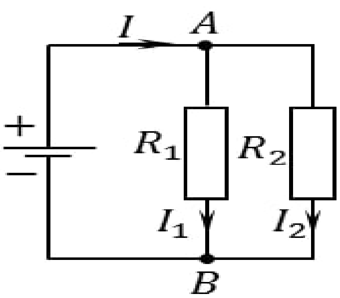
Giving a problem	Students who solved problems (normalized to the total number of students) %
1-option Two consumers with resistance R $_1$\u003d 12 Ohms R $_2$\u003d 3 ohms are connected to the emf source. E = 12V as shown in the diagram. Find the current strength in the sections of the circuit, and in the unbranched part of the circuit. 	From 45% Up to 65%
Option 2 Current capacity and car battery 50 A h , operating voltage 12V. 50W and 60W low and high beam lamps are connected to the battery , respectively [1]. Draw a wiring diagram for the lamps. Find the current in the lamps and the total current consumption from the battery.	Less than 10%

Note: Table 2 shows the results of the survey in 36 academic groups during the 2nd academic semester of the 2020-2021 academic year.

This suggests that the results of the survey can be assessed as satisfactory. However, with such a formulation of the problem, students do not develop practical skills. The theoretical knowledge gained during the lesson is quickly forgotten, since this knowledge has no practical basis.

These and many similar facts in teaching methods can explain the decline in recent years of the results of monitoring residual knowledge in subjects.

[1]Note: Typically, e lamps (incandescent) are available with a power of 50/60 W, for low / high beams. The power of LED lamps with the same light output is 7-8 times less than incandescent lamps.

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Ways to solve the problem

To solve this issue, it is necessary to specify the task, or, in other words, it is necessary to take tasks from practice. To do this, we formulate the problem statement in the following form, as shown in the second version of Table 2. As can be seen, with such a problem statement, the results are sharply reduced. Although the purpose of teaching this topic is aimed at studying just such practical problems.

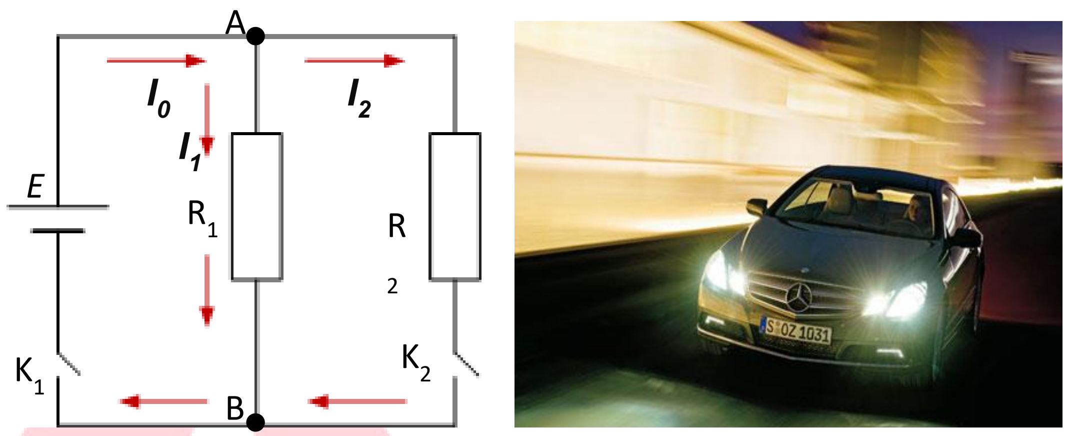

Fig.1. An electrical circuit of a branched circuit (a) and its practical application in a car lighting system (b).

Applying the method of nodal potentials, we have:

I 1 = P 1 / U = 50 W / 12 V = 4.16 A.

I 2 = P 2 / U = 60 W / 12 V = 5 A.

According to Kirchhoff's law, the current in the unbranched sections of the circuit

I \u003d I 1 + I 2 \u003d 4.16 A + 5 A \u003d 6.16 A.

In the course of solving the problem of circuit and direct current, it is necessary to dwell on current sources. As is known, chemical current sources are most often used in the DC circuit, and as shown above, the characteristics of these sources are usually neglected, and what this led to shows the results of the survey.

It should also be noted that in recent years, due to the energy shortage, much attention has been paid to the development of alternative energy sources. At the same time, of course, the issue of electricity accumulation, that is, the use of batteries, is on the agenda. At the same time, of course, it is important to know the electrical and energy parameters of the battery when conducting energy calculations. For example, knowing the energy parameters of an individual consumer, it is possible to determine the energy intensity of the battery, corresponding to this power . In order to achieve a level of energy literacy that can solve such problems, it is important to study the fundamental physical quantities in terms of their practical application, as noted above.

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CONCLUSIONS

In conclusion, it should be noted that in today's era of rapid technological progress, globalization and information technology, education must also meet the characteristics of speed, simplicity and practicality. To do this, it is necessary to focus on the practical aspects of each subject, relying on the fundamental foundations of the relevant theoretical knowledge. These requirements pose specific questions for the education of each subject, the essence of which lies in the revision of educational materials, taking into account their practical significance. At the same time, the main attention should be paid specifically to the practical development of educational materials, using specific technological examples from the production or domestic use of electrical appliances.

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