IMPROVEMENT OF THE TEACHING METHODS OF ELECTRICAL ENGINEERING IN HIGHER MILITARY EDUCATION INSTITUTIONS

Pazilova Shohida Abdulbasitovna
Senior lecturer at the Academy of the Armed Forces

ABSTRACT

In this article, it's considered the questions, of course, teaching the basics of electrical engineering. The technology of the organization and carrying out of practical lessons is opened and as a variant of the decision of some problems on the basis of long-term pedagogical experience, and also modern last recommended methodical instructions on teaching of the given course have resulted.

Keywords: Educational process, electrical engineering, technology, experience, methodology, circuit calculation, problem-solving, research, student.

INTRODUCTION, LITERATURE REVIEW AND DISCUSSION

Legislative initiatives adopted in recent years in Uzbekistan allow for the modernization of higher education at a higher level. The President Decree of the Republic of Uzbekistan No. 2909 of 20 April 2017 "On measures for further development of the higher education system" is a key document in the field of improving the quality of training of specialists in military higher education institutions of the country. [1]

The educational process in military higher education institutions should fully reflect modern trends in pedagogical science. The requirement for modern education encourages teachers to search for new modern effective teaching technologies and introduce new educational technologies into the educational process.

One of the main tasks in the educational process is to develop the interest of cadets in learning, creativity. This problem can be solved by using modern teaching technologies in the classroom, allowing to diversify the forms and means of education, increasing the creative activity of cadets.

These technologies help to organize the educational process in a rational way, to apply a person-centered approach, to actively use training facilities and ICT, and to develop self-control and mutual control. The following methods can be used in person-centered technology: problem-based approach; individual and differentiated approach to learning; group and couple work.

Problem-based learning can be used at the stages of communicating the topic and objectives of the lesson. To ensure that the student does not lose interest in the subject, it is important to organise an individual approach: to learn to work independently, develop imagination, creative thinking, ability to observe, analyze, compare, generalise, show initiative, and use time rationally. In an individual approach, everyone works on their own task. Different cadets - different tasks. Cards allow to provide individual work depending on the level of cadets' readiness.

One of the control cards is shown below.

Checklist

<table>
<tr><td colspan="5">Task content</td><td rowspan="2">Answers</td><td colspan="2">If the answer is wrong, repeat</td></tr>
<tr><td>№ subject</td><td>№ classes</td></tr>
<tr><td colspan="5">Determine the active power of the P circuit using the specified r, X_L, X_C and U</td><td rowspan="6">30 Wt
60 Wt
90 Wt
120 Wt</td><td rowspan="6">4</td><td rowspan="6">1</td></tr>
<tr><td rowspan="2">Values</td><td colspan="4">Variants</td></tr>
<tr><td>1</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td>r, Ohm</td><td>30</td><td>40</td><td>60</td><td>60</td></tr>
<tr><td>X_L, Ohm</td><td>20</td><td>20</td><td>100</td><td>90</td></tr>
<tr><td>X_C, Ohm</td><td>60</td><td>50</td><td>20</td><td>30</td></tr>
<tr><td>U, B</td><td>100</td><td>75</td><td>100</td><td>60</td></tr>
</table>

Teaching practice shows that the qualitative assimilation of the subject cannot be achieved without exercises to solve typical problems and perform the cycle of calculation and graphic works.

The role and importance of practical works are also given due importance in terms of psychological and pedagogical requirements. If the lecture lays the foundation for scientific knowledge in a generalized form, then the practical exercises are designed to deepen, expand and detail this knowledge, contribute to the development of professional skills [2]. The methodology and technology of practical training should contribute to the acquisition of necessary knowledge, development of the cadets' independence in the educational work.

It is very important for the success of the practical lessons that the cadets work independently on the topic of the planned lesson. Experience shows that practical exercises should not be limited to the development of practical skills, problem-solving techniques, chain calculation, charting, etc. The trainee should always see the leading idea of the course and its connection with practice. An important part of the practical lessons is solving problems or conducting exercises. Individual authors [3,4] see the purpose of classroom exercises in the following tasks:

1) Train students to use the basic laws of electrical engineering to solve specific problems.

2. Check the level of students' understanding of the issues discussed in the lecture and the work with teaching aids, as well as the degree and quality of assimilation.

3. 3. Help students acquire skills to develop algorithms to solve standard tasks, which is important for independent work on the course.

The factor that increases the interest of the students in the course is the inclusion of elements of inventive activity into the practical work, which contribute not only to the successful mastering of the subject but also to the improvement of the level of general technical education.

The carefully selected material should be used to solve problems. They should be chosen or designed to cover important topics. It is desirable that the mathematical calculations in the tasks be as concise as possible. The methodological value of the tasks, in our opinion, consists in the fact that they contribute to the deepening of theoretical concepts, mastering the methods of applying the theory to practice with clarity of conditions and availability of the solution. Each task proposed to the students should be solved in advance and methodically processed by the teacher.

For the independent work of cadets on solving problems it is necessary to specify collections and methodical manuals in which several typical problems are developed, their detailed decisions are given, possible errors and possible variants of decisions are shown. The best method of problem-solving is the one that creates the most favorable conditions for achieving the didactic goal. Methods are often used in which the solution of separate tasks is controlled by algorithms. S.I. Arkhangelsky noted fairly that algorithms form "a clear style of thinking, skills in the use of prescriptions, rules, instructions, recipes, etc., cultivates objectivity and indicates the way to solve problems in the shortest possible way" [5]. Algorithms can be used even when indicating the ways of solving problem tasks. Along with the algorithmic approach, it is reasonable to use other approaches [6].

Well-known methods of sinusoidal current circuit calculation (vector diagrams, conductivity and complex variables) are used in solving problems with different schemes of resistance connections and ways of their general solution are usually explained on the basis of algorithmic approach. The essence and algorithms of solving typical problems are given in the lectures.

For example, the solution of typical problems on electric circuits of single-phase sinusoidal current is taken by the following contents.

Let's consider an example where the connection scheme and the problem condition are given in the following form (Fig. 1).

It is given: voltage at the input of the circuit U, active resistance r, inductance L at frequency constancy f. Determine: the values of current I, voltages at individual sites of U_r, U_L, U_C; active, reactive and total power of the circuit P, Q_L, Q_C and S; the angle of shear between current and voltage φ

Solution: First, the circuit impedance $Z = \sqrt{(r^2 + (X_L - X_c)}$ is calculated; current value $I = \frac{U}{z}$ is determined; there are voltages and powers $U_r = rI$, $U_L = X_L I$, $U_C = X_C I$ и $P = rI^2$, $Q_C = X_L I^2$ and $S = UI$; shear angle between current and voltage $\varphi = arctg \frac{x}{r}$..

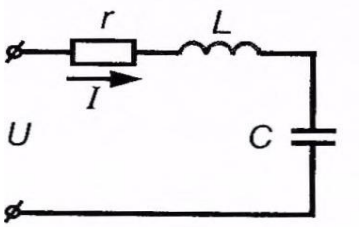

Fig. 1. Scheme of consecutive connection.

Further, there may be additional requirements to solve the tasks: 1) build a vector diagram based on the results of calculations (Fig. 2); 2) make an algorithm of problem-solving (Fig. 3); 3) calculate the required parameters on the computer.

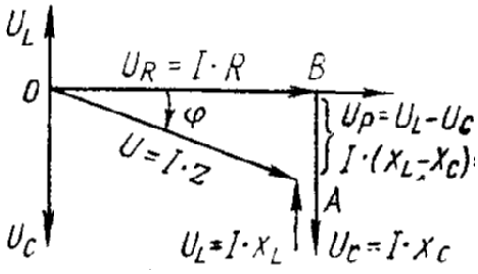

Fig. 2. Vector diagram.

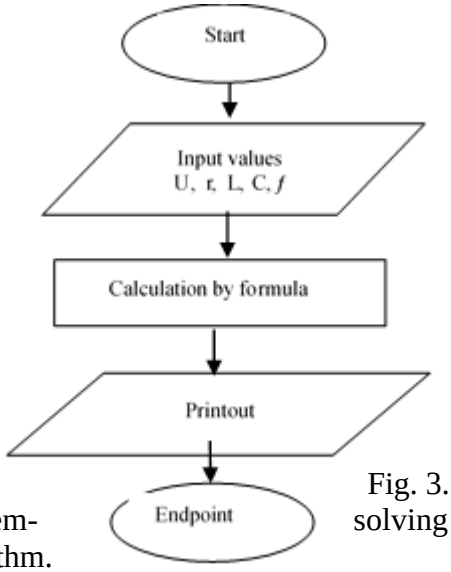

Fig. 3. The problem-solving algorithm.

Let's consider the calculation of branched AC circuits using the conductivity method.
The inductance coils are connected in parallel (Fig. 4.) and have resistances: r_1 = 6 Ohm; X_{L1} = 8 Ohm; r_2 = 8 Ohm; X_{L2} = 6 Ohm. Energy source voltage $U = 220$ V, frequency f = 50 Hz. Determine the current in the non branched out part of the circuit I and the active power P.

Solution. Let's define conductivity:

$g_1 = r_1/z_1^2 = 6/(6^2+8^2) = 6\cdot10^{-2}$Sm; $b_1 = X_{L1}/z_1^2 = 8/(6^2+8^2) = 8\cdot10^{-2}$Sm;

$g_2 = r_2/z_2^2 = 8/(8^2+6^2) = 8\cdot10^{-2}$Sm; $b_2 = X_{L2}/z_2^2 = 6/(8^2+6^2) = 6\cdot10^{-2}$Sm;

$y = \sqrt{(g_1 + g_2)^2 + (g_1 + g_2)^2} = \sqrt{(6 \cdot 10^{-2} + 8 \cdot 10^{-2})^2 + (8 \cdot 10^{-2} + 6 \cdot 10^{-2})^2} =$
$= 19{,}7 \cdot 10^{-2}$Sm.

Current in the non-extended part of the circuit $I = U \cdot y = 220 \cdot 19{,}7 \cdot 10^{-2} = 43{,}4$ A. Active power $P = U^2 g = 220^2 (6 \cdot 10^{-2} + 8 \cdot 10^{-2}) = 6776$ watts.

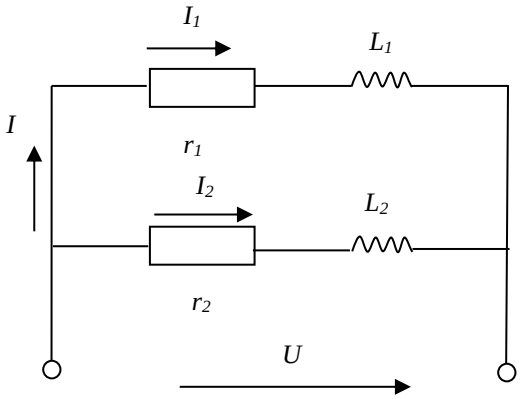

Fig. 4. Circuit with two inductors connected in parallel.

The article summarizes the results of research and many years of experience in teaching the course on the basics of electrical engineering to cadets of a higher military education institution. Theoretical and experimental researches have allowed to open didactic and psychologically-pedagogical feature of teaching of the given course in military higher educational institutions, to define ways of optimisation of educational process for the purpose of studying of electrotechnics and increase of a role of this subject. On the basis of the conducted researches

the scientific substantiation of the concept about the importance of electrotechnical knowledge in the formation of professional training of future officers was received.

The choice of methods for effective practical training on the basics of electrical engineering was made. It was taken into account that the practical use of known methods of training is combined with the introduction into the educational process of the principles and methods inherent in the specific didactic goal, contributing to the formation of the creative qualities of specialists.

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