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METHODOLOGY OF LABORATORY LESSONS IN ELECTRICAL ENGINEERING

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Abstract

A laboratory workshop's goal is usually to: specify abstract educational material and deepen the concepts studied in theoretical courses, teach practical research methods and the ability to use special experimental tools; instill general and specific experimentation skills; and form practical skills in setting up devices and conducting electrical circuit measurements. In most cases, the stated duties can be solved to some degree using the usual method of arranging and conducting laboratory classes. However, this is insufficient, because a modern specialist must be trained to acquire knowledge freely, think creatively, and communicate effectively in the workplace.

Key words: measurement in electrical circuits, electrical measuring instruments, single-phase current circuits, three-phase current circuits and electrical machines, rectifying three-phase AC.

Laboratory classes allow students to integrate theoretical and methodological knowledge and practical skills into a single process of educational and research activities. Because of the rapid evolution of the laboratory activity in its present form, practically all graduates should be equipped for experimental research work.

Laboratory work has a high degree of uniqueness based on the individual specialization; consequently, personalized methodological advice are preferable to general pedagogical ones in this scenario. The selection of instructional material content is not restricted to the scientific aspect of the subject. The practical material of the training course should create the major types of professional activity of the future expert in accordance with the principles of the activity approach and the concept of the development of a creative personality.

In addition to recognizing the importance of a laboratory workshop in the educational process, it is necessary to define the major responsibilities of laboratory classes. To teach the skills and abilities of handling the listed equipment and experimental techniques; to teach to generalize and formalize the results of research; to instill the skills of laboratory research preceding production tests and the ability to understand their results; to instill the skills of laboratory research preceding production tests and the ability to understand their results; to instill the skills of laboratory research preceding production tests and the ability to understand their results Use laboratory classes to evaluate students' independent work on theory [1].

An important side effect of the laboratory workshop is that the teacher can control the independent work of students on the course and take timely action if this work is not done enough. This moment is especially important for courses that do not have practical classes in the curriculum or have an insignificant number of hours for

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them, when it is not possible to control the student's independent work in practical classes. For the above reasons, it is considered more rational to use the parallel method of conducting laboratory classes, i.e., theoretical material, after its presentation in the lecture, is immediately taken to the laboratory workshop. In this case, the frontal method of performing laboratory work is optimal. But this method requires a large amount of the same type of work, requiring a large number of instruments and equipment. In this case, it is advisable to apply a compromise parallel-serial or cyclic method. Work in the laboratory is divided into several cycles, and a specific cycle begins after the lecturer has read the necessary material; during the execution of the work of this cycle, the lecture continues and students receive the information necessary for the work of the next cycle, etc. In particular, in our laboratory, the workshop is divided into cycles: electrical measuring instruments, single-phase current circuits, three-phase current circuits, and electrical machines [2].

Until the lecture on the provision of the first cycle has been delivered, practical exercises are allowed. They can be devoted to solving problems of electrical measurements, calculations of circuits with various ways of connecting resistances, etc. The content of the work of the laboratory workshop is chosen in such a way that it corresponds to the essence of the course being studied. The nature and topics of the work should take into account both professional training and the specifics of the specialty. For students studying in the motor transport direction, when conducting laboratory work on rectifying a three-phase alternating current, it is necessary to focus students' attention on the rectifier blocks of the AC generators of cars (Fig.1.). Each work should cover any issue or section of the course. With the cyclic method of work, the theme of the cycle should correspond to some section of the theoretical course and should ensure systematic and consistent learning. The cycle's works should complement one another and not be repeated. An example is the content of the first cycle of works [3]. As a result, the student should get the most complete understanding of the instruments of direct assessment. It is desirable in each job to provide, in addition to the mandatory program, additional tasks related to, for example, controlling and measuring devices in cars. This stimulates students to expand and deepen their knowledge and increases their interest and independence. It is important to correctly determine the scope of each assignment and the time allotted for it.

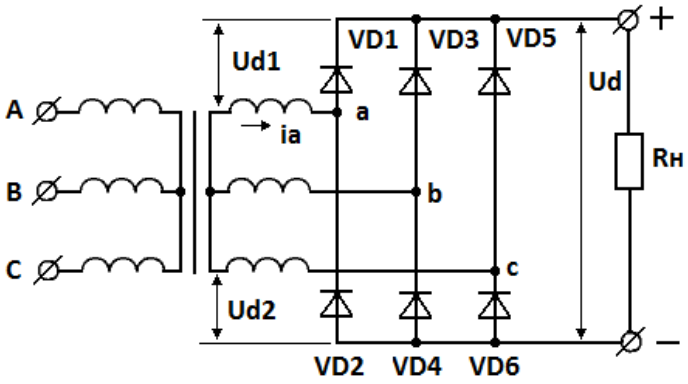

Figure 1. Three-phase bridge rectifier

To reduce the time required to prepare a report on laboratory work in recent years, our department has developed a special report form where the student only has

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to fill in the appropriate tables (the results of the measurements) and draw graphs. But experience has shown that, without specific methodological recommendations, students find it difficult to defend laboratory work. Therefore, to help students perform laboratory work, special manual-guides were prepared, which contain a system of methodological instructions that reveal to students the goals and content of the forthcoming work as well as the features of using instruments and equipment [4-6].

The work of students in a laboratory lesson proceeds in the form of studying a manual, compiling the required records, drawing up electrical circuits and coordinating them with the teacher, performing measurements and filling in tables with the data obtained, processing data results, performing calculations and calculations, building graphs and diagrams, assessing errors in measurements, generalizing the obtained data, and drawing up conclusions. When the validity of a theoretical dependence is being checked, it is important to show the degree of agreement between theoretical and experimental dependences by constructing appropriate graphs, tables, etc.

When studying electrical measuring instruments, it is important to learn their design features. The principle of operation of measuring mechanisms is to acquire the skill of including the device in the circuit, taking the reading of the device based on the correct determination (especially for multi-limit and multi-scale devices) of the division value, and learning to obtain correction curves as a result of comparing the tested devices with the reference ones. On the basis of an experimental study of transformers and electrical machines, they gain practical skills in turning them on and operating them, removing and studying performance characteristics, and assimilating the principle of operation on the basis of elucidating the electromagnetic phenomena occurring in these devices. In the process of preparing and conducting experiments, students can use individual advice from the teacher [7].

A report on the work performed is compiled by each student and drawn up after the completion of the work in extracurricular time. The volume and content of the report are determined by the assignment for this work. The quality of the final report testifies to the effectiveness of the implementation of the pilot study by the student. The report must be approved by the teacher and, if its quality does not meet the established requirements, then it must be finalized by the student. Work on finalizing and improving the quality of reports is an additional means of intensifying and activating students' independent work. The report should contain brief information on the theory, calculation formulas, schemes for which experiments were carried out, tables of measured values, data of measuring instruments (system, nominal values, accuracy class, etc.), basic calculation ratios used in this work, graphs and vector diagrams, and conclusions based on the results of the work. In the report, graphic symbols in diagrams, as well as letter symbols, must be drawn according to the standard. Graphs and vector diagrams are drawn to scale on graph paper. It is possible to represent multiple functional dependencies from a single argument on a single graph. For each of these dependencies, their own scales should be indicated, plotted parallel to the coordinate axes. During the quality control of the work, the knowledge and skills acquired by students are checked during the defense of the work [8]. The student is allowed to defend himself if there is a report drawn up in accordance with the requirements for it. During the defense, the correctness of the content of the report, the

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correctness of the calculations and conclusions are preliminarily checked, and the knowledge of students is determined during the interview and by answering questions. Usually, after the defense of the last laboratory work, the teacher automatically issues a credit for laboratory classes and notes in the journal.

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