Improvement Of The Requirements For The Training Of Engineering Personnel In Materials Science And Technology Of Construction Materials

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ABSTRACT

The article analyzes the role of state educational standards in the training of engineering and technical personnel in higher education, as well as the qualification requirements for the engineering and technical specialty, and the requirements for the training of specialists in "Material science and technology of construction materials" comments on improvement are presented.

Keywords: Higher education, State educational standard, qualification requirements of specialization, qualification requirements for engineering and technical specialization, requirements for training specialists in "Material science and technology of construction materials"

As one of the important direct productive factors of the society, the influencing role of fundamental sciences in all branches of production, mainly in mechanical engineering, energy, transport, is increasing. Based on society's requirements for highly qualified specialists, the tasks of higher education institutions are clearly defined in the State Educational Standard of Higher Vocational Education [1, 2].

In this regard, below, based on the analysis of the standard for the training of engineering-technical personnel by specialty, we present some considerations on improving the requirements for the training of specialist personnel in the field of "Materials science and technology of construction materials". we found the tooth necessary [4, 8].

In the first section of the requirements for the training of specialists in "Materials science and technology of construction materials", there is a general description of the direction of training, then the role of specialization in the field of science and technology, which regulates the fields of professional activity in the standard, and the objects of professional activity and types are discussed.

The qualification requirements of the specialty are reflected in the description of the qualification requirements of the specialty (state regulatory document), in which, first of all, the professional importance of the specialist and the conditions of its use, and then the qualification requirements for the specialist in the form of solving the system of professional and social tasks, preparation for it is provided by the organization and content of the

educational process in higher education institutions. To determine the knowledge and skills of a graduate of higher education institutions, the results of the analysis of the tasks solved by engineers in various specialties were used on the basis of the following materials (qualification descriptions, passports of various specialties, etc.).

The qualification requirements for the specialist are divided into groups by department: 1) social direction of the specialist's activity; 2) the object and purpose of the specialist's activity; 3) the main problems of development in the field of public practice. The qualification description determines the tasks (work activities) of engineers in various specialties. It is necessary to use it as a source document in the development of educational plans and to determine the programs of educational subjects, to take into account the organization of the educational process and production practice in technical specialties of higher educational institutions.

Graduates of various specialties can be trained to perform the following types of professional activities: design-construction, production-technological; organizational management; scientific research; repair and maintenance. Specific types of activities are determined by the content of the professional education program developed by higher education institutions.

The tasks of the professional activity, in turn, determine that the engineer will be prepared to solve the following tasks:

a) production and technological activity: organization of exploitation of equipment and technologies in various fields and control of its safe operation; organization of the production and technological process, development of technological documents, control of compliance with the quality and technology of work on the production and repair of rolling stock; effective use of materials and equipment in rolling stock maintenance and repair;

b) organizational and management activities: organization of executive team, making management decisions; finding a compromise between various requirements (price, quality, safety and deadlines) and determining optimal solutions in long-term and short-term planning; assessment of production and non-production costs to ensure product quality; implementation of technical control and quality control in rolling stock design and production; training and attestation (certification) of service personnel;

c) design and development activities: formulating the goals of the project, criteria and methods for achieving the goals, building the structure of their relations, determining priority directions for solving problems taking into account the ethical aspects of the activity; development of generalized options for problem solving, analysis of options, prediction of consequences, finding compromise solutions in conditions of multi-criteria, uncertainty, planning, implementation; use of computer technologies; design of new models of rolling stock; development of project documents for the production and repair, modernization and modification of rolling stock; development of technical conditions, standards projects, etc.

d) research activities: collecting and analyzing information on research objects; analysis of the state and dynamics of activity objects using the necessary analysis methods and tools; modeling of the studied phenomenon or processes; development of research plans, programs and methods; technical and organizational support for the implementation of scientific and research works; analysis of research results and development of proposals for implementation.

According to the qualification requirements, the engineer performs and supervises work on the organization of production, labor and management, metrological support, technical control, design, information service in the field of scientific and technical activities to solve professional problems; rational use of natural resources, energy and materials; develops methodological and regulatory materials, technical documents, proposals and measures for the implementation of developed projects;

It fully justifies the decisions made and implemented on the basis of technical and economic analysis, looks for ways to shorten the work cycle, helps to prepare the process of their implementation, provides necessary technical information, materials, equipment;

Implementation of scientific and research works, development of projects and programs,

testing of machines and equipment, implementation of necessary measures for commissioning, study of technical documents, consideration of various technologies, preparation of reviews, etc. participates in the standardization of technical means, systems, processes, equipment and materials;

Researches and analyzes necessary information such as technical data, work indicators and results, summarizes and systematizes them, makes necessary calculations using modern technical tools;

Creates work schedules, orders, applications, instructions, explanatory letters, maps, diagrams and other technical documents, as well as prepares a report in approved forms and within approved deadlines; provides methodological and practical support in the implementation of projects and programs, plans and contracts;

Performs technical expertise based on monitoring the condition and operation of equipment, identifies reserves, determines the causes of existing deficiencies and malfunctions in its operation, takes measures to eliminate them and increase the efficiency of their use, including:

- ensures compliance with safe working conditions and established requirements, norms, standards and regulations in technical operation;
- organizes work on improving the scientific and technical knowledge of employees;
- development of creative initiative, rationalization, inventiveness, introduction of scientific and technical achievements, use of best practices that ensure the effective operation of the institution, organization, and others.

Based on the above, the engineer must know the following:

- technical operation rules and instructions for ensuring traffic safety;
- normative, methodological and guidelines related to the objects of his professional activity;
- technical development prospects and characteristics of the institution, organization, enterprise;
- principles of work, developed and used technical tools, materials and the working principle, properties, and structural features of the machine;
- research methods, rules and conditions of work;
- requirements for technological documents, materials, products;
- methods of performing technical calculations, determining the economic efficiency of research and development;
- scientific and technical achievements, advanced local and foreign experience in the field of relevant knowledge;
- fundamentals of economy, organization of production, labor and management, labor legislation and legal regulation of the field;
- requirements and standards for ensuring safety, labor protection, safety equipment, production sanitation and fire safety in production.

If we consider these requirements for certain fields of knowledge, then the standard is formulated in a general sense based on the requirements for the level of training of specialists, for example, an engineer must imagine the processes and events that occur in inanimate and living beings as a whole.

An engineer must understand the capabilities of modern scientific methods of understanding nature and master them to the extent necessary to solve problems that have a natural science content and arise in the performance of professional tasks. The processes in nature and modern scientific methods of knowledge of nature, as the main component of fundamental education, are explained primarily by the knowledge of physics, but in the teaching of material science and technology of construction materials, as well as special sciences, the unique fundamental knowledge arising from physics is dislocation theories. , crystallography, fractography, fullerenes, dislocation-structural mechanisms of brittle decay of materials, plasticity, strength theory, etc., but the standard does not have such requirements for fundamental training. Various fundamental training requirements, which are not sufficiently specified in the standard, weaken the theoretical component of programs on materials science and technology of construction materials. The standard requires

graduates to have the knowledge necessary to solve the problems that arise in the performance of professional functions. This means that it is related to the professional training of students in the teaching of physical and technical sciences.

According to the standard, a graduate of OTM should be capable of project activities in the professional field based on a systematic approach. In scientific knowledge, it is necessary to distinguish not only the systematic, but also the scientific essence (substrate) in the designed object. An engineer must build and use models to describe and predict various phenomena, perform their qualitative and quantitative analysis, which requires adequate fundamental training in physics and mathematics and the ability to apply this knowledge in professional activities. The requirements for the natural-scientific training of engineers in the fields of physics, theoretical mechanics, chemistry and ecology are presented in a general form without sufficient specifications. From these requirements, we distinguish those that can be used in teaching materials science and technology of construction materials, that is, it is important for an engineer to know and be able to use the following in his professional activities:

- basic concepts, laws of mechanics, electricity and magnetism, vibrations and waves, quantum physics, statistical physics and thermodynamics;
- theoretical and experimental research methods in physics, theoretical mechanics;
- the ability to estimate the numerical order of magnitude characteristic of various fields of natural science;
- methods of obtaining and using electrical and other energies, methods of analysis and synthesis of electromechanical and electronic devices, electrical control systems, components of electronic equipment, etc.;
- the basic physical and chemical laws for describing the properties of engineering materials;
- methods of modeling and calculation of electric and magnetic circuits, calculation of parameters of electric and electronic devices;
- experimental data processing methods;
- methods of evaluating the main characteristics of engineering materials;
- to have the experience of choosing materials based on the analysis of their physico-chemical properties for specific use in production.

Requirements for personnel training in "Materials science and technology of construction materials" should take into account the connection with special disciplines, for example:

- to have an idea about the problems of improving the quality of mechanical engineering products;
- to know and be able to use knowledge about electrophysical and electrochemical methods of processing;
- to have experience that requires appropriate fundamental training not only in physics, but also in technical sciences in order to perform tasks such as planning and processing of single and multi-factor experiments, using computer technologies in solving engineering problems, and technical control of mechanical engineering products.

In addition to the basic courses, it is desirable to introduce courses of additional subjects for standard regional programs and curricula. Therefore, it is considered necessary for an engineer to have the following concepts in natural and scientific sciences: knowledge of the physical foundations of non-destructive and non-destructive control methods in mechanical engineering; ability to use physical effects in creating technical tools.

In general, an engineer is required to know and be able to use physical effects used in non-destructive testing equipment in mechanical engineering, and to have skills in applying physical effects to equipment that implements non-destructive testing techniques in mechanical engineering.

The conclusion from the analysis of the state standard is that in order to successfully carry out activities in his specialty, an engineer must have deep fundamental scientific knowledge, know the areas of their application in professional activities, and this should be done in the educational process aimed at solving various industry problems. can be achieved by integrating different fundamental knowledge.

That is, he should have knowledge of the fundamentals of science - physics, which is the foundation of science and technology development. He must clearly and clearly understand where and how the laws of physics and the scientific and technical theories based on them are applied in various objects.

At this point, the training plan for engineering specialists for many fields of technology and engineering envisages the teaching of the comprehensive subject "Material science and technology of construction materials". In the materials science section of the course, the structure of metals, diffusion processes in metal, the formation of the structure of metals and alloys during crystallization, plastic deformations, the effect of heating on the structure and properties of deformed metal, mechanical properties of metals and alloys, structural metals and alloys, heat treatment of steel refers to the study of the theory and technology of giving, chemical-thermal treatment, refractory, corrosion-resistant, tool-making alloys [3,4,6,7].

In the department of construction materials technology, theoretical and technological bases of materials production, main methods of obtaining solids, theory and practice of "zagotovka" formation; classification of methods of obtaining them, production of "zagotovka" of details; production of inseparable compounds; production of welding, soldering, adhesive materials; obtaining compounds that cannot be separated by gluing, physical-technological bases of obtaining products from metal, powder, eutectic and polymer composite materials and methods of product preparation; production of rubber zagotovka; selection of methods of processing detail surfaces, basic methods of production of complex details; criteria and principles of assessment of technologicalness of technical constructions, provision of technologicalness; the basics of machine assembly technology, dimensional chains, their calculation methods, the use of computers for the development of assembly units, the technological processes of manufacturing the main equipment of engineering structures and electrical equipment; use of advanced technologies and computers in the production of products. It is necessary to summarize the requirements for teaching in the field of "Materials science and technology of construction materials", because the physical and mechanical properties of materials first determine the structural parameters of engineering products; secondly, the technological parameters of processing details and assembling products from them; because it ensures durability and reliability of the product [3,6,7].

It is not necessary to teach the specialist how to solve all the problems encountered in his work, but it is important to develop the right thinking concept and the ability to creatively approach solving tasks. Therefore, it is necessary for a future specialist-engineer to have a certain amount of technical knowledge on a deep fundamental basis at the level of scientific and technical development, to be able to solve problems in all types of activities in his field.

"Materials science and technology of construction materials" determines the solution of engineering problems, plays a decisive role in all stages of design, design of technical processes, production of details, parts and units, and assembly of machines. But in materials science, due to scientific and technical progress, new tasks constantly appear, requiring modern new materials that have high performance properties such as strength, heat resistance, corrosion resistance, chemical stability, so new materials - construction, tooling, composite, polymer, light and special alloys are created and used. New allotropic forms of materials are being discovered, which allow to obtain materials with certain functional properties, if the change of the structure of the materials, depending on the working conditions, does not reduce its strength, but rather increases it, it is of great practical importance.

In the current requirements of materials science, new promising materials are not sufficiently taken into account, because iron-carbon alloys, although elemental structural changes in them have been studied, in the future more attention will be paid to light alloys, composites, polymers and other promising materials. , which will displace traditional materials with the introduction of more of them

in production. Structural changes in alloys under operating loads, mechanisms of structural changes, dislocation-structural mechanism of material degradation have not been sufficiently studied, now, as previously thought, these do not determine the reliability of materials at the strength limit. The requirements for the specialist allow to determine the structure of the curriculum and the content of the training programs reflected in the qualification specification.

However, both the qualification description, the structure of the curriculum, and the content of the programs require correction in relation to the new integrated approach to assessing the durability of materials during operation. Such a situation of the problem in the training of engineering specialists requires an assessment based on the structure of curricula and the content of engineering specialty programs. Based on this situation, it is appropriate to focus on the qualification requirements of training engineers in the analysis of sample training programs[5,7].

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