MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

UKRAINIAN STATE UNIVERSITY

RAILWAY TRANSPORT

APPROVED

Protocol of the meeting of the Academic Council of the Ukrainian State University of Railway Transport

"04" June 2020 № 04

Put into action

from the 2020/2021 education year

Rector

\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Serhii PANCHENKO

**EDUCATIONAL AND PROFESSIONAL PROGRAM**

ELECTRIC LOCOMOTIVES AND ELECTRIC TRAINS

|  |  |  |
| --- | --- | --- |
|  | Level of higher education: | second |
|  | Degree of higher education: | master |
|  | Branch of knowledge: | 27 Transport |
|  | Specialty: | 273 Railway transport |

Kharkiv – 2020

**1. Preamble**

The Law of Ukraine "On Higher Education" provides that:

1) educational-professional program - a single set of educational components (academic disciplines, individual tasks, practices, control measures, etc.) aimed at achieving the learning outcomes provided by such a program, which gives the right to receive a certain educational or educational and professional (professional) qualifications (qualifications);

2) the standard of higher education defines the following requirements for the educational program: the amount of ECTS credits required to obtain the appropriate degree of higher education; requirements for the level of education of persons who can start training under this program and the results of their training; list of mandatory competencies of the graduate; normative content of training of applicants for higher education, formulated in terms of learning outcomes; forms of certification of higher education applicants; requirements for the creation of educational training programs in the field of knowledge, two branches of knowledge or a group of specialties (in the standards of the junior bachelor's level), interdisciplinary educational and scientific programs (in the standards of master and doctor of philosophy); requirements of professional standards (if any);

3) the educational program must contain: list of educational components, their logical sequence; requirements for the level of education of persons who can start training under this program; the number of ECTS credits required for the implementation of this program, as well as the expected program learning outcomes (competencies), which must be mastered by the applicant;

4) the institution of higher education on the basis of the relevant educational program develops a curriculum that determines the list and amount of educational components in ECTS credits, their logical sequence, forms of organization of the educational process, types and scope of classes, schedule, current forms and final control, ensuring that the applicant achieves the appropriate degree of higher education program learning outcomes. On the basis of the curriculum, individual curricula for each academic year are developed and approved for each applicant in higher education in the order determined by the institution of higher education.

Educational and scientific program "Electric locomotives and electric trains":

1) was developed on the basis of the Standard of Higher Education of the second (master's) level in specialty 273 Railway transport of the knowledge industry 27 Transport, approved and put into effect by order of the Ministry of Education and Science of Ukraine dated 10.07.2019 No. 966, the working group of the Department of Electrical Power Engineering, Electrical Engineering and Electromechanics of the of the Ukrainian State University of Railway Transport consisting of:

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| --- | --- | --- |
| YATSKO  Serhii | – | Associate professor of the Department of Electrical Power Engineering, Electrical Engineering and Electromechanics, Candidate of Science (Engineering), team leader; |
| BABAIEV  Mykhailo | – | Professor of the Department of Electrical Power Engineering, Electrical Engineering and Electromechanics, Doctor of Technical Science, Head of the Department; |
| KARPENKO  Nadiia | – | Associate professor of the Department of Electrical Power Engineering, Electrical Engineering and Electromechanics, Candidate of Science (Engineering); |
| SUSHKO  Dmytro | – | Associate professor of the Department of Electrical Power Engineering, Electrical Engineering and Electromechanics, Candidate of Science (Engineering); |

involving and taking into account the positions and needs of the following stakeholders:

|  |  |  |
| --- | --- | --- |
| HLAZKOV  Oleksii | – | Head of the Personnel and Social Policy Service Department of the regional branch of UZhD JSC Ukrzaliznytsia; |
| TERENKO  Vladyslav | − | Deputy General Director for Operation, municipal enterprise "Kharkiv Metro" |
| BILOPOLSKYY  Viacheslav | − | student of group 10-3EEc of the Faculty of Mechanical and Energy of the Ukrainian State University of Railway Transport |
|  |  |  |

2) approved at the meeting:

Department of Electrical Power Engineering, Electrical Engineering and Electromechanics from May 25, 2020 (Protocol No. 12);

Scientific and Methodological Commission of the Faculty of Mechanical and Energy of June 01, 2020 (Protocol No. 11);

Scientific Council Faculty of Mechanical and Energy of June 01, 2020 (Protocol No. 11);

3) approved at the meeting of the Scientific Council of the Ukrainian State University of Railway Transport on "04" June 2020 (Protocol No 04).

**2. Profile of the educational and professional program "Electric locomotives and electric trains"**

**2.1. General characteristic**

|  |  |
| --- | --- |
| Level of higher education | The second (master's) level |
| Degree of higher education | Master |
| Branch of knowledge | 27 Transport |
| Specialty | 273 Railway transport |
| Restrictions on forms of education | There are no restrictions |
| Educational qualification | Master of Railway Transport from electric locomotives and electric trains |
| Qualification in the diploma | Degree (level) of higher education - Master  Specialty - 273 Railway transport  Educational and professional program - Electric locomotives and electric trains |
| Description of the subject area | The objects of the master's study are the life cycle processes of electric locomotives and electric trains.  Objectives of the educational and scientific program:  training of competitive specialists capable of complex solution of complex specialized scientific, applied, practical tasks of research and / or innovative nature, characterized by complexity and uncertainty of conditions for development, design, construction, operation, repair , modernization, utilization of objects of electric locomotives and electric trains of railway transport;  acquisition of universal knowledge based on fundamental theories, concepts, ideas, principles, combined into a single worldview system as a factor of further professional growth and the ability to solve a wide range of general problems;  formation of spirituality, spiritual culture of personality, in particular through the development of its spiritual needs, the creation of psychological and pedagogical conditions for spiritual development, as the basis of personal development of the specialist, the development of human potential of the country;  ensuring the possibility of creative self-realization of the individual by creating an educational environment that promotes self-knowledge, self-esteem, self-development, which is based on academic freedom, mobility, integrity and student-centered learning; acquisition of social skills of business communication, management as an element of professional activity of a specialist. Theoretical content of the subject area: sections of science and technology, which study and combine the links and patterns in the theory of creation, maintenance, use for its intended purpose, as well as the disposal of electric locomotives and electric trains of railway transport;. Methods, techniques and technologies: analytical, numerical and experimental methods, methods and technologies of design, research and testing of electric locomotives, electric trains and their components, technologies of production, operation, modernization and utilization. Tools and equipment: control and measuring devices and equipment, field samples and models of electric locomotives and electric trains, specialized software, computer diagnostic systems. |
| Academic and professional rights of graduates | Opportunity to study according to the program of the third (educational-scientific) level of higher education. Acquisition of additional qualifications in the system of postgraduate education |
| Number of semesters / years of study | 3/1 year, 4 months |

**2.2. Requirements for the level of education of persons who can start training in the educational-professional program:** existence of educational degree of the bachelor, master (educational and qualification level of a specialist).

**2.3. Number of ECTS credits required to complete the educational and research program** is 90 ECTS credits.

The practice must be at least 4 ECTS credits.

At least 35 percent of the educational program should be directed to the acquisition of general and special (professional) competencies in the educational and professional program defined by the Master's Standard in Higher Education in 273 Railway transport of knowledge 27 Transport, approved and implemented by order of the Ministry Education and Science of Ukraine dated July 10, 2019 № 966.

The scope of students' free choice disciplines should be at least 25 per cent of the total number of ECTS credits provided for in the educational programme.

**2.4. Expected program learning outcomes (competencies) to be mastered by the applicant**

|  |  |  |
| --- | --- | --- |
| **Integral competence** | Ability to solve complex problems and problems in the field of railway transport, namely, electric locomotives and electric trains, or in the process of further training using the provisions, theories and methods of natural, technical, informational and socio-economic sciences, which provides for research and / or innovation and is characterized by complexity and uncertainty of conditions and requirements | |
| **General competencies** | GC 01 | Knowledge and understanding of the subject area and understanding of professional activity. |
| GC 02 | Ability to communicate in a foreign language |
| GC 03 | Skills in the use of information and communication technologies |
| GC 04 | Ability to conduct research at the appropriate level |
| GC 05 | Ability to search, process and analyze information from various sources |
| GC 06 | Ability to identify, pose and solve problems |
| GC 07 | Ability to make informed decisions |
| GC 08 | Ability to work in an international context |
| GC 09 | Ability to develop and manage projects |
| GC 10 | Ability to evaluate and ensure the quality of work performed |
| **Special (professional, subject) competencies** | PC 01 | Ability to work in a group on large projects, including using social skills of business communication and management in the field of railway transport |
| PC 02 | Ability to apply a systematic approach to solving engineering problems in solving engineering problems in the development, design, construction, operation, repair, modernization, disposal of electric locomotives and electric trains and their components |
| PC 03 | Ability to take into account the needs of users and customers and the importance of issues such as aesthetics in the design of electric locomotives and electric trains and their components |
| PC 04 | Ability to take into account social, environmental, ethical, economic and commercial considerations that affect the implementation of technical solutions in railway transport |
| PC 05 | Ability to solve scientific and production problems in the field of railway transport, demonstrating an understanding of the broader interdisciplinary engineering context |
| PC 06 | Ability to address challenges by demonstrating an understanding of the need to comply with high-level professional and ethical standards, as well as the legal framework relevant to the operation of Ukrainian railway facilities, including personnel, health, safety and risk (including environmental risk ) |
| PC 07 | Ability to research, analyze and improve the technological processes of railway transport in accordance with electric locomotives and electric trains |
| PC 08 | Ability to make effective decisions on the choice of materials, equipment and measures for the implementation of the latest technologies in railway transport in accordance with electric locomotives and electric trains |

**Program training results**

TR 01. To know and understand modern methods of scientific research, organization and planning of experiment, computerized methods of research and processing of results.

TR 02. Solve problems in the creation, operation, maintenance, repair and disposal of electric locomotives and electric trains, including on the border with related industries, engineering, physics, ecology and economics.

TR 03.Freely present and discuss the scientific results in the State language and in English or one of the languages of the European Union countries in oral and written form.

TR 04. Develop and propose new technical solutions and apply new technologies.

TR 05. Be able to use universal and specialized life cycle management (PLM), computer-aided design (CAD), manufacturing (CAM) and engineering research (CAE) systems in their professional activities.

TR 06. Develop and implement energy saving technologies.

TR 07. Organize and manage the work of the primary production, design or research unit, using social skills of business communication and management, strive for personal growth as an organizer and leader.

TR 08. Know and apply the necessary methods and tools of research, develop and analyze physical, mathematical and computer models of research objects related to the creation, operation and repair of electric locomotives and electric trains, related railway facilities.

TR 09. Be able to transfer their knowledge, decisions and the basis for their adoption to specialists and non-specialists in a clear and unambiguous form, to present the results of work performed in the form of reports, abstracts, scientific articles, reports and applications for findings.

TR 10. Manage technological processes in accordance with job responsibilities, ensure technical safety of production in the field of their professional activity.

TR 11. Perform technical and economic calculations, comparison and justification of the processes of design, construction, production, repair, renovation, operation of electric locomotives and electric trains.

TR 12. Know and identify possible risks, ensure personal safety and safety of other people in the field of professional activity.

TR 13. Use in the field of professional activity quality systems and product certification.

TR 14. Calculate the characteristics of electric locomotives and electric trains.

TR 15. Develop and optimize the parameters of technological processes, including the use of automated computer-aided production of components, units and systems of electric locomotives and electric trains.

Correspondence of training results and competencies is shown in table 1, the correspondence of learning outcomes and educational components - in table 2.

**3 The list of educational components and their logical sequence**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| № | Educational component | Number of ECTS credits | Duration of study (in semesters) | Form of final control |
| **CYCLE OF GENERAL TRAINING** | | | | |
| EC1 | Occupational safety and civil protection | 4 | 1 | examination |
| EC2 | Design of electromechanical systems and their presentation in the language of the European Union. | 4 | 1 | test |
| EC3 | Economics of locomotive economy | 3 | 1 | test |
| EC4 | Promising systems of automated traction electric drive | 7 | 1 | examination |
|  | The volume of normative educational components | 18 | - | - |
| **Disciplines of free choice of the student of a cycle of general preparation** | | | | |
| FC1 | Discipline 1\*\* | 3 | 1 | \* |
| FC 2 | Discipline 2\*\* | 3 | 1 | \* |
|  | The volume of selective educational components | 6 | - | - |
|  | **The total amount of educational components of the cycle** | **24** | - | - |
| **CYCLE OF PROFESSIONAL TRAINING** | | | | |
| EC5 | Automatic ERS control systems | 4 | 1 | examination |
| EC6 | Traction electric machines | 4 | 1 | examination |
| EC7 | Power electronics of electric locomotives and electric trains | 4,5 | 1 | examination |
| EC8 | Features of design and dynamics of high-speed transport | 4 | 1 | examination |
|  | The volume of normative educational components | 16,5 | - | - |
| **Disciplines of free choice of the student of a cycle of professional training** | | | | |
| FC3 | Discipline 1\*\* | 4 | 1 | \* |
| FC4 | Discipline 2\*\* | 3 | 1 | \* |
| FC5 | Discipline 3\*\* | 3 | 1 | \* |
| FC6 | Discipline 4\*\* | 3 | 1 | \* |
| FC7 | Discipline 5\*\* | 4 | 1 | \* |
| FC8 | Discipline 6\*\* | 4 | 1 | \* |
|  | The volume of selective educational components | 21 | - | - |
|  | **The total amount of educational components of the cycle** | **37,5** | - | - |
| EC9 | Pre-diploma practice | 6 |  | test |
| EC10 | Qualification examination to verify achievement of training results | 1,5 | - | examination |
| EC11 | Preparation and protection of master's degree qualification work | 21 |  | protection |
| **TOTAL VOLUME OF THE EDUCATIONAL PROGRAM** | | **90** |  |  |

\* - the form of final control is determined by the curriculum;

\*\* - the educational component is determined by the results of students' choice in accordance with the established procedure.

The logical sequence of studying the educational components is determined by their order at the beginning of the study. The educational components of the next turn cannot be studied before or simultaneously with the beginning of the study of the educational components of the previous turn.

The order of study of educational components:

1) educational components of the first turn:

objects of the existing and next generation;

2) educational components of the second stage:

means and technologies to increase the efficiency of electric locomotives and electric trains and their systems during the life cycle;

3) educational components of the third stage:

pre-diploma practice

4) educational component of the fourth stage:

preparation for the defense of the final qualifying work.

5) the order of study of other educational components is determined by the curriculum.

**4 Form of certification of applicants for higher education**

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| --- | --- |
| Forms of certification of applicants for higher education | Certification is carried out in the form of a single state qualification exam (qualification exam) and public defense of qualification work |
| Requirements for the unified state qualification exam | The unified state qualification exam (qualification exam) should check the achievement of training results |
| Requirements for qualification work | Qualification work should involve solving a complex specialized (scientific, applied, practical) problem or practical problem of research and / or innovation, characterized by the complexity and uncertainty of conditions and requirements for the development, design, construction, operation, repair, modernization, disposal of electric locomotives and electric trains.  Qualification work should not contain academic plagiarism, fabrication, falsification.  Qualification work must be published on the official website or in the repository of the Ukrainian State University of Railway Transport, or on the website of its structural unit |

**5. Requirements for the availability of an internal quality assurance system for higher education**

The Ukrainian State University of Railway Transport has a system of quality assurance of educational activities and quality of higher education (internal quality assurance system), which provides for the implementation of the following procedures and measures:

1) definition of principles and procedures for quality assurance of higher education;

2) monitoring and periodic review of educational programs;

3) annual evaluation of applicants for higher education, scientific, pedagogical and pedagogical staff of the institution of higher education and regular publication of the results of such assessments on the official website of the institution of higher education, on information stands and in any other way;

4) providing advanced training of pedagogical, scientific and scientific-pedagogical workers;

5) ensuring the availability of the necessary resources for the organization of the educational process, including independent work of students, according to the educational program;

6) ensuring the availability of information systems for effective management of the educational process;

7) ensuring publicity of information about the educational program, degree of higher education and qualification;

8) ensuring an effective system for preventing and detecting academic plagiarism in the scientific works of employees and applicants for higher education.

Table 1 - Matrix of correspondence of training results and competencies

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Program training results | Competencies | | | | | | | | | | | | | | | | | | |
| Integral competence | General competencies | | | | | | | | | | Special (professional, subject) competencies | | | | | | | |
| GC01 | GC02 | GC03 | GC04 | GC05 | GC06 | GC07 | GC08 | GC09 | GC10 | PC01 | PC02 | PC03 | PC04 | PC05 | PC06 | PC07 | PC08 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 25 |
| TR 01 | Ability to solve complex problems and problems in the field of railway transport, namely, electric locomotives and electric trains, or in the process of further training using the provisions, theories and methods of natural, technical, informational and socio-economic sciences, which provides for research and / or innovation and is characterized by complexity and uncertainty of conditions and requirements | **+** |  |  | **+** |  | **+** |  |  | **+** |  |  | **+** |  |  | **+** | **+** | **+** |  |
| TR 02 | **+** |  | **+** |  |  |  |  |  | **+** | **+** |  |  | **+** | **+** | **+** | **+** |  |  |
| TR 03 |  | **+** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| TR 04 | **+** |  |  |  | **+** | **+** | **+** |  | **+** | **+** | **+** |  |  |  | **+** | **+** | **+** | **+** |
| TR 05 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| TR 06 |  |  |  |  |  |  |  |  |  |  |  |  |  | **+** | **+** |  |  |  |
| TR 07 |  |  |  |  |  | **+** |  |  |  |  | **+** |  |  |  |  | **+** |  |  |
| TR 08 | **+** |  |  | **+** | **+** | **+** |  |  | **+** | **+** |  | **+** |  |  | **+** |  |  | **+** |
| TR 09 |  |  |  |  |  |  |  |  |  |  | **+** |  |  |  | **+** |  |  |  |
| TR 10 | **+** |  |  |  |  |  | **+** |  |  | **+** | **+** |  |  | **+** |  | **+** |  | **+** |
| TR 11 |  |  |  |  |  |  |  |  |  |  |  | **+** |  |  |  |  | **+** | **+** |
| TR 12 | **+** |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **+** |  |  |
| TR 13 | **+** |  |  |  |  |  |  |  |  |  |  |  | **+** | **+** |  | **+** |  |  |
| TR 14 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **+** |
| TR 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **+** |  |

Table 2 - Matrix of correspondence of training results and educational components

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Program training results | Educational components | | | | | | | | | | |
| EC01 | EC02 | EC03 | EC04 | EC05 | EC06 | EC07 | EC08 | EC09 | EC10 | EC11 |
| TR 01 |  |  |  |  |  |  |  |  | **+** | **+** | **+** |
| TR 02 |  |  |  | **+** |  |  |  |  | **+** | **+** | **+** |
| TR 03 |  | **+** |  | **+** |  |  |  |  | **+** | **+** | **+** |
| TR 04 |  |  |  | **+** | **+** | **+** | **+** | **+** | **+** | **+** | **+** |
| TR 05 |  |  |  | **+** |  |  |  |  | **+** | **+** | **+** |
| TR 06 |  |  |  | **+** | **+** | **+** | **+** | **+** | **+** | **+** | **+** |
| TR 07 | **+** | **+** | **+** |  |  |  |  |  | **+** | **+** | **+** |
| TR 08 |  |  |  |  | **+** |  | **+** | **+** | **+** | **+** | **+** |
| TR 09 |  |  |  | **+** |  |  |  |  | **+** | **+** | **+** |
| TR 10 |  |  | **+** |  |  |  |  |  | **+** | **+** | **+** |
| TR 11 |  | **+** | **+** | **+** | **+** | **+** | **+** | **+** | **+** | **+** | **+** |
| TR 12 | **+** |  |  |  |  |  |  |  | **+** | **+** | **+** |
| TR 13 |  |  |  |  |  |  |  |  | **+** | **+** | **+** |
| TR 14 |  |  |  | **+** |  | **+** | **+** | **+** | **+** | **+** | **+** |
| TR 15 |  |  | **+** | **+** | **+** | **+** | **+** | **+** | **+** | **+** | **+** |

|  |  |  |
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| Professor of the Department of Electrical Power Engineering, Electrical Engineering and Electromechanics, Head of the Department |  | M. Babaiev |
| Associate Professor of the Department of Electrical Power Engineering, Electrical Engineering and Electromechanics, Team Leader |  | S. Yatsko |
| Associate Professor of the Department of Electrical Power Engineering, Electrical Engineering and Electromechanics |  | N. Karpenko |
| Associate Professor of the Department of Electrical Power Engineering, Electrical Engineering and Electromechanics |  | D. Sushko |
| Head of student self-government  Faculty of Mechanical and Energy, 4th year student  (first (bachelor's) level) |  | V. Yevsiukov |