



School of Transport Engineering and Logistics  
The direction of "Transport engineering"

### **EDUCATIONAL PROGRAM**

"6B07124 - Technology of production, repair and operation of locomotives"

Code and classification of the field of education: 6B07 Engineering, manufacturing and construction industries

Code and classification of the field of study: 6B071 Engineering and engineering

Group of educational programs: B 065 Transport equipment and technologies

The level of the NQF: 6

The level of the IQF: 6

Study period: 4

Volume of loans: 240

**Almaty, 2023**






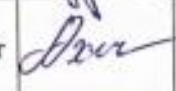


The educational program "6B07124 - Technology of production, repair and operation of locomotives" was approved at a meeting of the Academic Council of KazNRTU named after K.I. Satbayev

Protocol no. 13 from «28» 04 2022 year

Reviewed and recommended for approval at a meeting of the Educational and Methodological Council of KazNRTU named after K.I.Satbayev.

Protocol no. 7 from «26» 04 2022 year

The educational program "6B07124 - Technology of production, repair and operation of locomotives" was developed by the Academic committee in the field of Transport Engineering and Logistics

Full name	Academic degree/ academic title	Position	Place of work	Sign
<b>Chairman of the Academic Committee:</b>				
Yelemessov Kasym Koptleuevich	Candidate of Technical Sciences, Professor	Director of the Institute of Energy and Mechanical Engineering after A. Burkitbayev	KazNRTU named after K.I.Satbayev	
<b>Teaching staff:</b>				
Bortebaev Sayin Abilkhanovich	Candidate of Technical Sciences, associate professor	Head of the Department of Technological Machines and Transport, Institute of Energy and Mechanical Engineering	KazNRTU named after K.I.Satbayev	
Abdullayev Seidulla Seidemetovich	Doctor of Technical Sciences, Professor	Professor	KazNRTU named after K.I.Satbayev	
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<b>Employers:</b>				
Beketov Tasbulat Sarsenbayevich	Master of Engineering and Technology	General manager	TOO «Mega Drive»	
<b>Students:</b>				
Makhalinova Dilnaz Beisenovna	Bachelor	2nd year undergraduate student	KazNRTU named after K.I.Satbayev	



## 1. DESCRIPTION OF THE EDUCATIONAL PROGRAM

The educational program "6B07124 -Technology of production, repair and operation of locomotives" in the field of personnel training 6B071- "Engineering and engineering" involves the training of highly qualified specialists in the field of production, operation, maintenance of locomotives and motor car rolling stock.

The educational program has been developed on the basis of the Industry Qualifications Framework in the field of "Railway Transport" in accordance with the following Professional Standards:

- Operation of locomotives and motor-car rolling stock;
- Quality control of locomotives after repair;
- Management and control of traffic safety in railway transport.

The professional standards "Technical operation, maintenance and repair of locomotives and motor-car rolling stock" and "Manufacture and manufacture of locomotives and motor-car rolling stock" are currently not developed.

The distribution of railway industry employees by job groups according to the IQF is shown in table 1.

Table 1 - Distribution of railway industry employees by job groups

Group	The requirement for the level of education	Qualification level according to the IQF
Top-level managers	Higher or postgraduate education	7,8
Managers	Higher or postgraduate education	5,6,7
	Technical and vocational education	5
Specialists	Higher or postgraduate education	5,6
	Technical and vocational education	4,5
Employees	Higher or postgraduate education	5
	Technical and vocational education	4,5
	Average	3
Employees	Technical and vocational education	4
	Average	2,3

Bachelors who have graduated from this OP correspond to the 6th level of the IQF and NQF and can work as a head of a structural unit (if they have work experience), a specialist and an employee at enterprises related to the production, operation, maintenance of locomotives and motor car rolling stock.

**Field of professional activity:** Railway transport, transport equipment and technologies.

The objects of the bachelor's professional activity are:

- divisions of industrial enterprises related to the production, operation, maintenance and repair of locomotives and motor-car rolling stock;
- - divisions of state institutions for the operation, repair and maintenance of locomotives and motor-car rolling stock;
- divisions of design organizations for the design, manufacture and technical support of innovative rolling stock;
- divisions of scientific organizations for research in the field of production, operation, maintenance and repair of locomotives and motor-car rolling stock.

The types of professional activity are:

- production and technological;



- organizational and managerial;
- service and operational;
- design;
- repair and technological.

**Functions of professional activity:**

- 1) Organization of operation, repair, diagnostics of locomotives, control over safe operation;
- 2) Development and implementation of technological processes for maintenance and repair, the use of standard methods for calculating the reliability of locomotive components.
- 3) Management of production processes, analysis of the results of production activities;
- 4) Management of work on the inspection and repair of locomotives;
- 5) Quality control of all types of locomotive repairs, control of the availability, condition and use of control and measuring instruments;
- 6) Analysis and evaluation of production and non-production costs or resources for high-quality maintenance and planned repairs.
- 7) Development of new technologies, development of design and technological documentation using computer technology;
- 8) Calculation of strength and stability under various types of loading, development of machine designs using design methods and fundamentals, selection of materials for the manufacture of machine parts, justification of technical solutions;
- 9) Development of technical specifications and technical specifications for projects of technological machines, locomotives or its components, technological processes, automation tools using information technology and computer programs;
- 10) Design of new samples of the locomotive, its components, assemblies, equipment, technological processes, automation and protection equipment that meet the latest achievements of science and technology, safety requirements.

**Key professional competencies:**

KC1 - Has broad and deep fundamental and applied knowledge and is ready to use it as a basis for practical engineering activities; knows and applies the best engineering practice in the chosen field of professional activity;

KC2 - Ready to apply fundamental and engineering knowledge considering national specifics, technical standards and professional regulations;

KC3 - Ready to pose, study and analyze complex engineering problems; is able to evaluate and select the necessary information; able to apply the necessary theoretical and practical methods to analyze complex engineering problems;

KC4 - Able to apply the necessary theoretical and practical methods, as well as the achievements of advanced engineering thought, in solving complex engineering problems;

KC5 - Able to appreciate the significance of the results and consequences of integrated engineering activities, take responsibility for the social, cultural and environmental consequences of integrated engineering activities in the context of sustainable development;

KC6 - Ready to solve, if necessary, problems of a methodological and research nature; Capable of developing and making solutions to complex engineering problems in complex environments with conflicting requirements and lack of information, using common sense;

KC7 - Ready for partial or full management of one or more types of complex engineering activities; able to apply knowledge to help ensure quality assurance, operational reliability, technical information and statistics;

KC8 - Ready to bear responsibility for making decisions when conducting complex engineering activities;

KC9 - Capable of generating new fundamental knowledge of an interdisciplinary and intersectoral nature; committed to innovation and creative solutions in engineering;



KC10 - Selects forms and schemes for certification of products (services) and processes, solves the problems of planning and carrying out work on standardization, certification and metrology, using the regulatory framework, modern methods and information technologies;

KC11 - Ready to: develop design documentation for the creation and modernization of locomotives; carry out calculation and design work on the creation and modernization of locomotives; develop technical documentation and methodological materials, proposals and activities for the creation and modernization of locomotives;

KC12 – Ready: to conduct a technical and economic analysis, comprehensively substantiate the decisions made and implemented in the field of operation, repair and maintenance of locomotives, their units, systems and elements; to apply the results in practice, the desire for self-development, improving one's qualifications and skills;

KC13 - Able to reasonably select structural materials and technologies in the manufacture of transport objects;

KC14 – Capable of using computer-aided design systems based on domestic and foreign software for the design of transport facilities;

KC15 - Able to apply the organizational and methodological foundations of metrological support when developing requirements for ensuring the safety of train traffic and performing work on technical regulation in transport;

KC16 - Capable of self-improvement and professional growth as an individual with diverse humanitarian and natural science knowledge and interests;

KC17 - Able to critically rethink the accumulated experience, change the profile of his professional activity if necessary, understand the social significance of his future profession, and have high motivation to perform professional activities;

KC18 – Able to find a compromise between various requirements (cost, quality, safety and deadlines) during long-term and short-term planning and make optimal decisions in the field of operation, repair and maintenance of locomotives, their units, systems and elements; possess a culture of thinking;

KC19 - Capable of generalization, analysis, perception of information, setting goals and choosing ways to achieve it.

Graduates of this EP can work in the following positions (Table 2):



Table 2. Work functions and professional skills and competencies according to approved Professional standards

Post	Labor functions	Professional skills/competencies
1	2	3
1. Chief Traffic Safety Specialist/Engineer (by level)	1. Monitoring compliance with traffic safety requirements when performing technological processes. 2. Control over the timely elimination of identified violations and inconsistencies of regulatory and technical documents. 3. Traffic safety risk management in your area of work.	1. Work in a coordinated and coordinated manner with employees of other structural divisions, understanding the needs and specifics of their work. 2. Participate in the development of measures aimed at ensuring and preventing cases of Traffic Safety Violations. 3. Apply various methods to improve the level of traffic safety. 4. To use technical and other means in the performance of work duties in order to receive and/or transmit information, computer, photocopying and other office equipment, appropriate communication and communication systems, databases and information resources.
2. Traffic Safety Engineer/The Inspector.	1. Record keeping in the traffic safety department in accordance with local regulations 2. Preparation and formation of materials for analysis of identified cases of traffic safety violations, work failures, as well as non-fulfillment of labor and performance discipline 3. Formation of reports on the execution of telegraphic instructions, protocol decisions	1. Keep a systematic record of outgoing documents from employees of the traffic safety department. 2. Generate and send received telegraphic instructions, protocol decisions, orders, official letters, reports, as well as to wagon and locomotive depots using the electronic document management system. 3. To form and send received telegraphic instructions, protocol decisions, orders, official letters, as well as to carriage and locomotive depots through correspondence. 4. Conduct official correspondence on train safety issues.
3. Senior duty officer of the locomotive depot/ Duty officer of the circulating locomotive depot	1. To direct the work of all the depot attendants. 2. To control the timely delivery of locomotives from maintenance. 3. Organization of the installation of locomotives for maintenance and repair, the issuance of locomotives for trains, according to the plan and schedule of the turnover of locomotives. 4. Work in information and analytical automated systems for organizing the implementation of a shift-daily plan 5. Arrange the driver's route. 6. Keep a desktop journal of the TU-1 form.	1. To make decisions on the organization of the implementation of the shift-daily plan by the depot attendants. 2. Analyze the data on the implementation of the shift-daily plan. 3. Work in information and analytical automated systems for organizing the implementation of a shift-daily plan. 4. Distribute the locomotive (motor car) fleet of locomotives (MCRS) by type of work. 5. Make decisions on the organization of the issuance of locomotives (MCRS) from maintenance and repair. 6. Control the maintenance of a desktop journal of the TU-1 form. 7. Analyze (compare) information on the availability and condition of locomotives (MCRS), the work of locomotive crews. 8. Apply various methods to improve the level of traffic safety. 9. Distinguish all types of locomotive equipment malfunctions
1	2	3
4. Thermal engineer of locomotive crews	1. Development of technical standards for fuel and energy consumption. 2. Work with automated control system EDT. 3. Preparation of documentation.	1. To make traction calculations taking into account various series of locomotives and serviced areas. 2. Determine the consumption of diesel fuel by diesel locomotives and electric energy by electric locomotives.



		<p>3. Develop energy consumption rates for train traction.</p> <p>4. Determine the mode of operation of the train on the site.</p> <p>5. Use computer graphics programs.</p> <p>6. To process information on cases of activation of the alarm system of the automated control system EDT.</p> <p>7. To make an analysis of fuel and energy complex expenses for train traction.</p> <p>8. Develop and justify proposals to the head for improving and saving fuel and energy resources.</p>
5. Head of the locomotive depot stock base	<p>1. Organization of the work of the locomotive stock base for the timely and high-quality performance of work on the maintenance of locomotives for conservation for long-term storage.</p> <p>2. Monitoring compliance with labor and production discipline by employees of the reserve base.</p>	<p>1. Make decisions to improve the quality of locomotive maintenance.</p> <p>2. To implement best practices in the organization of maintenance of locomotives.</p> <p>3. Ensure the rational use of materials for repair work.</p> <p>4. Present the material in an accessible form and provide the necessary methodological assistance in mastering knowledge on locomotive maintenance (MCRS).</p>
6. Leading engineer of the Locomotive Repair Control Department	<p>1. Conducting work to control the wear of ridges and bandages.</p> <p>2. Maintaining documentation of reports to the central office.</p>	<p>1. Analyze wheel-motor block rollouts.</p> <p>2. Analyze the condition of the wheelset bandages.</p> <p>3. Submit a report to the Central Base.</p> <p>4. To control the quality of the technical (service) maintenance performed by the locomotive.</p> <p>5. Analyze data in order to improve the quality of acceptance/installation of locomotives for unplanned repairs and maintenance.</p>
7. Senior receiver of locomotives (locomotive depot)/ The receiver of the locomotives of the locomotive depot	<p>1. Control of the production and labor discipline of locomotive receivers.</p> <p>2. Participation in the autumn and spring commission inspections.</p> <p>3. Quality control of repair work and maintenance of locomotives.</p> <p>4. Acceptance of locomotives, motor car rolling stock, wagons, assemblies and equipment after repair and maintenance.</p> <p>5. Inspection control of organizations that repair locomotives and motor-car rolling stock</p> <p>6. Analysis of the results of the work</p>	<p>1. Choose the means and methods of monitoring the performance of work on the repair and maintenance of locomotives (motor car rolling stock).</p> <p>2. Check compliance with the deadlines for the repair and maintenance of locomotives (motor car rolling stock) established by relevant regulatory legal acts and local acts, with the adoption, if necessary, of corrective measures</p> <p>3. Check the parameters during the repair and maintenance of locomotives (motor car rolling stock), components and equipment to take action.</p> <p>4. Monitor the performance of repair and maintenance of locomotives (motor car rolling stock), components and equipment.</p>

1	2	3
		<p>5. To check the serviceability of locomotives (motor car rolling stock), components and equipment after all types of repairs and maintenance in the organization with their admission to the owner's infrastructure with the adoption, if necessary, of corrective measures</p> <p>6. To collect data on the results of work on the repair and maintenance of locomotives (motor car rolling stock), as well as their acceptance (admission to the infrastructure) for their analysis.</p> <p>7. Analyze the causes of defects identified during the acceptance (admission to infrastructure) of locomotives (motor car rolling stock),</p>



		components and equipment, in order to develop proposals for their prevention and elimination (taking corrective measures).
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## 1. THE PURPOSE AND OBJECTIVES OF THE EDUCATIONAL PROGRAM

**The purpose of the EP:** Training of competent and competitive specialists who possess the theoretical and practical competencies necessary to carry out qualified work based on the latest technologies of design, manufacture, use, maintenance, repair and operation of locomotives.

### **Objectives of the educational program:**

1. Formation of a person capable of self-improvement and professional growth with diverse humanitarian and natural science knowledge and interests.
2. Formation of the ability to critically rethink the accumulated experience, change, if necessary, the profile of their professional activities, awareness of the social significance of their future profession, having a high motivation to perform professional activities.
3. Formation of the ability to find a compromise between different requirements (cost, quality, safety and deadlines) in long-term and short-term planning and make optimal decisions in the field of operation, repair and maintenance of locomotives, their units, systems and elements; possess a culture of thinking,
4. Formation of the ability to generalize, analyze, perceive information, set goals and choose ways to achieve it.
5. Assistance in the formation of graduate readiness: to develop design documentation for the creation and modernization of locomotives; to perform design work on the creation and modernization of locomotives; to develop technical documentation and methodological materials, proposals and measures for the creation and modernization of locomotives.
6. Formation of graduates' readiness to conduct a technical and economic analysis, comprehensively substantiate the decisions taken and implemented in the field of operation, repair and maintenance of locomotives, their aggregates, systems and elements; application of the results in practice, striving for self-development, improving their qualifications and skills.
7. Assistance in the formation of graduates' readiness for the economical and safe use of natural resources, energy and materials during the operation, repair, and maintenance of locomotives.

## 2. REQUIREMENTS FOR EVALUATING THE LEARNING OUTCOMES OF AN EDUCATIONAL PROGRAM

The educational program "6B07124 - Technology of production, repair and operation of locomotives" ensures that all students achieve the planned learning outcomes necessary for professional activity. Upon completion of the program, students must:

LO 1 - To study the socio-ethical norms and the importance of spiritual processes in today's society, interpersonal and legal interests of the parties in the implementation of qualified work.

LO 2 - To adapt information from natural science disciplines to describe the processes and construction, development and improvement of models, systems and objects of transport equipment.

LO 3 - Apply the achievements of modern computer technology and software in all areas of the transport industry



LO 4 - To develop a set of measures to ensure life safety, environmental protection and labor protection, based on the analysis of harmful and dangerous factors at locomotive enterprises

LO 5 - To make organizational and economic management decisions based on the analysis of supply and demand, the dynamics of the transport market.

LO 6 - To solve technical problems of strength, reliability and stability of machines, structures and structural elements based on the laws of mechanics

LO 7 - To analyze the practical application of electrical and electronic equipment on rolling stock based on the analysis of promising and innovative technologies.

LO 8 - To evaluate the reliability indicators of parts and components of rolling stock using modern methods and diagnostic tools based on normative-technical documents and technical standards.

LO 9 - To assess the technical condition and parameters of rolling stock components in order to optimize their designs, technical characteristics and performance indicators.

LO 10 - To develop a technological process for maintenance, repair and diagnostics of locomotive parts and assemblies using mechanization, diagnostics and automation tools.

LO 11 - To analyze the criteria for the use of locomotives to ensure the safe operation of locomotives when interacting with railway infrastructure facilities

*The main principles of LO assessment is:*

- objectivity, reliability, transparency of information provision;
- focus on improving teaching and learning process;
- compliance of the assessment tools for students' achievements with the learning outcomes defined in the State and subject standards;
- objectivity, reliability, transparency of information provision;
- compliance of norms, requirements and indicators of educational achievements of students with their abilities, interests, social needs and personal development requirements;
- the consistency of the analysis of intermediate and final results of the assessment of educational achievements of students;
- compliance with basic ethical standards during the assessment.

Three types of assessment are used to measure LO: diagnostic, formative and summative.

Diagnostic assessment is used to assess the student's progress - during the academic semester, the teacher compares the initial level of formation of the student's competencies with the results achieved. The results of the diagnostic assessment serve as a basis for making adjustments and improving the learning process by setting learning objectives for the teacher and learning objectives for the student.

Formative assessment is used to determine the student's progress, taking into account the individual characteristics of mastering the material (the pace of work, methods of mastering the topic, etc.), as well as in order to develop recommendations for success. The teacher uses formative assessment to adjust training in a timely manner, make changes to planning, and the student to improve the quality of the work he does.

The student's progress is defined as the achievement of certain results, laid down for the purpose of learning within the educational fields, based on the specific work performed by the student. With a mark in the electronic journal, the teacher records observations of the student's individual progress.

Summative assessment is used to determine the degree of achievement of the student of the results planned for each stage of training, and consists of the current, intermediate and final assessment.

The current assessment of individually completed tasks is carried out depending on the assessment standards (the number of correct decisions, the number of mistakes made, following the rules of registration, etc.) and the criteria for completing individual work set by the teacher and /or the students themselves. The teacher conducts an ongoing assessment depending on the individual characteristics of the student when mastering the educational material.



The intermediate assessment is carried out on the basis of the types of work defined in the syllabus of the discipline: written work/work with sources; oral response / presentation; project, research work, specific types of work; portfolio (folder of achievements), etc. All types of work are evaluated on the basis of assessment criteria, are mandatory and are planned by the teacher in advance when developing an assessment plan.

The final assessment is conducted in accordance with the academic calendar and is carried out in writing in accordance with applicable standards and developed assessment criteria.



### 3. PASSPORT OF THE EDUCATIONAL PROGRAM

#### 3.1 General information

№	Field name	Note
1	2	3
1	The code and classification of the field of education	6B07 Engineering, manufacturing and construction industries
2	The code and classification of training areas	6B071 Engineering
3	Group of educational programs	B065 – Transport equipment and technologies
4	Name of the educational program	"6B07124 -Technology of production, repair and operation of locomotives"
5	A brief description of the educational program	<p>The educational program "6B07124 - Technology of production, repair and operation of locomotives" involves the training of highly qualified specialists in the field of production, operation, maintenance of locomotives and motor car rolling stock.</p> <p>The educational program has been developed on the basis of the Industry Qualifications Framework in the field of "Railway Transport" in accordance with the following Professional Standards:</p> <ul style="list-style-type: none"> <li>- Operation of locomotives and motor-car rolling stock;</li> <li>- Quality control of locomotives after repair;</li> <li>- Management and control of traffic safety in railway transport.</li> </ul>
6	The purpose of the EP	Training of competent and competitive specialists with theoretical and practical competencies necessary to carry out qualified work based on the latest technologies of design, manufacture, use, maintenance, repair and operation of locomotives
7	Type of EP	New
8	The level of the NQF	6
9	The level of the IQF	6
10	Distinctive features	Double degree
11	The list of competencies of the educational program	<p>KC 1 - know the basic sections of mathematics, physics, engineering graphics; have the basic knowledge necessary to study professional disciplines</p> <p>KC 2 - be able to demonstrate knowledge and understanding in the professional field</p> <p>KC 3 - be able to bring information, ideas, problems and solutions in the field of operation, repair and maintenance of locomotives</p> <p>KC 4 - be able to critically rethink the accumulated experience, change the profile of their professional activities if necessary, be aware of the social significance of their future profession, have high motivation to perform professional activities</p> <p>KC 5 - possess the skills to find a compromise between various requirements (cost, quality, safety and deadlines) in long-term and short-term planning and is able to make optimal decisions in the field of operation, repair and maintenance of locomotives, their units, systems and elements</p>



1	2	3
		<p>KC 6 - be able to generalize, analyze, perceive information, set goals and choose ways to achieve them; can formulate arguments and solve problems in the field of operation, repair and maintenance of locomotives; is able to collect and interpret information to form judgments taking into account social, ethical and scientific considerations</p> <p>KC 7 - know the classification, layout, technical characteristics of modern locomotives and be able to analyze the efficiency of using locomotives in various operating conditions</p> <p>KC 8 - be ready to develop design documentation for the creation and modernization of locomotives</p> <p>KC 9 - be able to perform design work on the creation and modernization of locomotives and develop technical documentation and methodological materials, proposals and measures for the creation and modernization of locomotives</p> <p>KC 10 - possess the methods of conducting technical and economic analysis, is able to substantiate the decisions taken and implemented in the field of operation, repair and maintenance of locomotives, their units, systems and elements; is able to apply the results in practice</p> <p>KC 11 - possess the skills of economical and safe use of natural resources, energy and materials during operation, repair, and maintenance of locomotives</p> <p>KC 12 - possess knowledge of the organizational structure, management and regulatory methods, performance criteria in relation to the locomotive industry, locomotive repair and locomotive assembly enterprises</p> <p>KC 13 - be able to master the features of maintenance and repair of technical and technological equipment and transport communications</p> <p>KC 14 - possess knowledge of the technical conditions and rules for the rational operation of locomotives, the causes and consequences of the termination of its operability</p> <p>KC 15 - to be able to master technologies and forms of organization of diagnostics, maintenance and repair of locomotives and equipment</p> <p>KC 16 - possess knowledge of the basics of occupational physiology and life safety, skills to act competently in emergency and emergency situations resulting from the operation, maintenance, repair and service of locomotives and equipment</p> <p>KC 17 - be able to analyze advanced scientific and technical experience and trends in the development of technologies for the operation, maintenance, repair and service of locomotives</p> <p>KC 18 - be able to perform theoretical, experimental, computational research on the scientific and technical justification of innovative technologies for the operation, maintenance, repair and service of locomotives</p> <p>KC 19 - be able to participate in the team of performers when performing laboratory, bench, landfill, acceptance and other types of tests of systems and means of operation, maintenance, repair and service of locomotives</p> <p>KC 20 - be able to use data from the assessment of the technical condition of locomotives using diagnostic equipment and by indirect signs</p>
1	2	3



		<p>GC 1 - have basic knowledge in the field of social and humanitarian disciplines that contribute to the formation of a highly educated personality with a broad outlook and a culture of thinking</p> <p>GC 2 - have the skills to handle modern technology, be able to use information technology in the field of professional activity</p> <p>GC 3 - have the skills to acquire new knowledge necessary for daily professional activities and continuing education in the master's degree</p> <p>GC 4 - be able to analyze and understand worldview problems from scientific positions, independently master cultural riches, think logically correctly and argumentatively and correctly build oral and written speech</p> <p>GC 5 - to be capable of self-knowledge, to critically assess one's strengths and weaknesses, to moral and physical self-improvement, to highly motivate one's professional and civic activity</p> <p>GC 6 - be capable of professional written and oral communication in Kazakh and Russian; know a foreign language at the level necessary to perform professional tasks</p>
12	Learning outcomes of the educational program	<p>LO 1 - To study the socio-ethical norms and the importance of spiritual processes in today's society, interpersonal and legal interests of the parties in the implementation of qualified work.</p> <p>LO 2 - To solve technical problems of strength, reliability and stability of machines, structures and structural elements based on the laws of mechanics</p> <p>LO 3 - To develop a technological process for maintenance, repair and diagnostics of locomotive parts and assemblies using mechanization, diagnostics and automation tools.</p> <p>LO 4 - To develop a set of measures to ensure life safety, environmental protection and labor protection, based on the analysis of harmful and dangerous factors at locomotive enterprises</p> <p>LO 5 - apply the achievements of modern computing technology, software in all areas of the transport industry</p> <p>LO 6 - To assess the technical condition and parameters of rolling stock components in order to optimize their designs, technical characteristics and performance indicators</p> <p>LO 7 - To analyze the criteria for the use of locomotives to ensure the safe operation of locomotives in interaction with railway infrastructure facilities</p> <p>LO 8 - To adapt information from natural science disciplines to describe the processes and construction, development and improvement of models, systems and objects of transport equipment.</p> <p>LO 9 - to make organizational and economic management decisions based on the analysis of supply and demand, the dynamics of the transport market.</p> <p>LO 10 - To analyze the practical application of electrical and electronic equipment on rolling stock based on the analysis of promising and innovative technologies.</p> <p>LO 11 - To evaluate reliability indicators of rolling stock parts and assemblies using modern diagnostic methods and tools based on regulatory and technical documents and technical standards.</p>
13	The form of education	full-time
14	The duration of the training	4
15	Volume of loans	240
16	Languages of instruction	Kazakh, Russian
17	Academic degree awarded	Bachelor of Engineering and Technology in the educational program "6B07124 -Technology of production, repair and operation of locomotives"
18	Developer(s) and authors	Abdullayev S.S., Kamzanov N.S., Tokmurzina-Kobernyak N.A. Alpeisov A.T., Zhumatayev A.K., Satybaldin A.E., Mansurov T.D., Imashev T.A.



**1.2. The matrix of correlation of learning outcomes according to the educational program as a whole with the competencies being formed**

Key competencies (KC)	Learning outcomes (LO)										
	LO1	LO2	LO3	LO4	LO5	LO6	LO7	LO8	LO9	LO10	LO11
GC1	V										
GC2	V										
GC3	V										
GC4	V										
GC5	V										
GC6	V										
GC7	V										
KC1		V						V			
KC2										V	V
KC3			V	V					V		
KC4		V		V		V					
KC5			V				V				
KC6	V		V	V	V				V		V
KC7		V				V	V				
KC8		V	V			V				V	
KC9		V	V			V			V	V	V
KC10							V		V		
KC11				V							
KC12				V					V		
KC13			V								V
KC14							V				
KC15			V								
KC16				V							
KC17						V	V				V
KC18		V			V	V					
KC19		V	V			V				V	V
KC20			V								V



### 1.3. The relationship between the achievability of the formed learning outcomes according to the educational program and academic disciplines

№	Name of the discipline	A brief description of the discipline	Number of credits	Generated learning outcomes (codes)										
				LO1	LO2	LO3	LO4	LO5	LO6	LO7	LO8	LO9	LO10	LO11
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	The cycle of general education disciplines Required component													
1	Foreign language	English is a discipline of the general education cycle. After determining the level (according to the results of diagnostic testing or IELTS results), students are divided into groups and disciplines. The name of the discipline corresponds to the level of English proficiency. During the transition from level to level, the prerequisites and post-prerequisites of discipline are observed.	10	V										
2	Kazakh (Russian) language	The socio-political, socio-cultural spheres of communication and functional styles of the modern Kazakh (Russian) language are considered. The course highlights the specifics of scientific style in order to develop and activate professional communication skills and abilities of students, allows students to practically master the basics of scientific style and develops the ability to produce a structural semantic analysis of the text.	10	V										
3	Physical Culture	General physical training (development of physical qualities). When planning the material of the practical section, it is recommended to use the following tools for the development of physical qualities: Like speed, endurance, flexibility, agility, strength. Special physical training. To choose the means of special physical training, various exercises can be used in terms of organization, methodological support, considering the region, sports and outdoor games.	8	V										

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
4	Information and communication	A required component. The task of studying the discipline is to acquire theoretical knowledge about information processes, about new information technologies, local and	5					V						



	technologies (in English)	global computer networks, information security methods; to gain skills in using text editors and tabular processors; to create databases and various categories of application programs.												
5	The history of Kazakhstan	The course studies historical events, phenomena, facts, processes that took place on the territory of Kazakhstan from ancient times to the present day. The sections of the discipline include: the steppe empire of the Turks; early feudal states on the territory of Kazakhstan; Kazakhstan during the Mongol conquest (XIII century), medieval states in the XIV-XV centuries. The era of the Kazakh Khanate of the XV-XVIII centuries. Kazakhstan as part of the Russian Empire, Kazakhstan during the Great Patriotic War, during the period of independence and at the present stage	5	V										
6	Philosophy	Philosophy forms and develops critical and creative thinking, worldview and culture, provides knowledge about the most general and fundamental problems of existence and gives them a methodology for solving various theoretical and practical issues. Philosophy expands the horizon of vision of the modern world, forms citizenship and patriotism, promotes self-esteem, awareness of the value of human existence. It teaches you to think and act correctly, develops practical and cognitive skills, helps you search and find ways and means of living in harmony with yourself, society, and the world around you	5	V										

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
7	Module of socio-political knowledge (sociology, political science)	The study of the course contributes to the formation of students' theoretical knowledge about society as an integral system, provides a political aspect of training a highly qualified specialist based on modern world and domestic political thought. The discipline is designed to improve the quality of both general humanitarian and professional	3	V										



		training of students. Knowledge in the field of sociology and political science is necessary to understand political processes, to form a political culture, to develop a personal position and more than												
8	Module of socio-political knowledge (cultural studies, psychology)	The module of socio-political knowledge (cultural studies, psychology) is designed to familiarize students with the cultural achievements of mankind, to understand and assimilate the basic forms and universal patterns of formation and development of culture. During the course of cultural studies, general problems of the theory of culture, leading cultural concepts, universal patterns and mechanisms of formation and development of culture, the main historical stages of the formation and development of Kazakh culture are considered. The patterns of the emergence, development and functioning of mental processes, states, properties of a person engaged in a particular activity, patterns of development and functioning of the psyche as a special form of vital activity are also studied.	5	V										

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	The cycle of general education disciplines Component of choice													
9	Fundamentals of scientific research methods	The purpose of the discipline is to develop the skills of organizing and planning scientific research, methods of conducting experimental research, methods of information processing. The discipline introduces students to the goals, objectives and stages of scientific research. The terms and concepts, the methodology of the experiment, mathematical methods of processing research results are considered. Concepts of engineering, laboratory and industrial experiment, bench research. The discipline introduces the basics of the theory of solving inventive tasks, with algorithmic methods of finding technical solutions and optimizing them. The main mathematical methods of optimization, the use of artificial intelligence capabilities to solve optimization problems, issues of search, accumulation and processing of scientific information are highlighted.	5			V								



10	Fundamentals of anti-corruption culture	The course introduces students to the improvement of socio-economic relations of the Kazakh society, the psychological characteristics of corruption behavior. Special attention is paid to the formation of an anti-corruption culture, legal responsibility for acts of corruption in various fields. The purpose of studying the discipline "Fundamentals of anti-corruption culture and law" is to increase public and individual legal awareness and legal culture of students, as well as the formation of a knowledge system and a civic position on combating corruption as an anti-social phenomenon. Expected results: to realize the values of moral consciousness and follow moral norms in daily practice; to work on improving the level of moral and legal culture; to use spiritual and moral mechanisms to prevent corruption.	5	V										
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
11	Fundamentals of Economics and entrepreneurship	The discipline studies the fundamentals of economics and entrepreneurial activity from the point of view of science and law; features, problematic aspects and prospects of development; theory and practice of entrepreneurship as a system of economic and organizational relations of business structures; readiness of entrepreneurs for innovative receptivity. The discipline reveals the content of entrepreneurial activity, career stages, qualities, competencies and responsibilities of an entrepreneur, theoretical and practical business planning and economic expertise of business ideas, as well as risk analysis of innovative development, the introduction of new technologies and technological solutions.	5									V		
12	Ecology and life safety	The discipline studies the tasks of ecology as a science, environmental terms, the laws of the functioning of natural systems and aspects of environmental safety in working conditions. Environmental monitoring and management in the field of its safety. Sources of pollution of atmospheric air, surface, groundwater, soil and ways to solve environmental problems; safety of life in the technosphere; natural and man-made emergencies	5				V							
The cycle of basic disciplines The university component														
13	Mathematics I		5											



		The course is designed to study the basic concepts of higher mathematics and its applications. The main provisions of the discipline are used in the study of all general engineering and special disciplines taught by graduate departments. The course sections include elements of linear algebra and analytical geometry, an introduction to analysis, and differential calculus of functions of one and several variables. The issues of methods for solving systems of equations, the application of vector calculus to solving problems of geometry, mechanics, physics. Analytical geometry on the plane and in space, differential calculus of functions of one variable, derivative and differentials, study of the behavior of functions, directional derivative and gradient, extremum of a function of several variables.									V			
14	Physics	The course examines the basic physical phenomena and laws of classical and modern physics; methods of physical research; the influence of physics as a science on the development of technology; the relationship of physics with other sciences and its role in solving scientific and technical problems of the specialty. The course covers the following sections: mechanics, mechanical harmonic waves, fundamentals of molecular kinetic theory and thermodynamics, electrostatics, direct current, electromagnetism, geometric optics, wave properties of light, laws of thermal radiation, photoelectric effect.	5								V			
15	Mathematics II	The discipline is a continuation of Mathematics I. The sections of the course include integral calculus of a function of one variable and several variables, series theory. Indefinite integrals, their properties and methods of their calculation. Definite integrals and their applications. Improper integrals. Theory of numerical series, theory of functional series, Taylor and Maclaurin series, application of series to approximate calculations.	5								V			
16	Engineering and computer graphics	The discipline is aimed at studying methods of depicting objects and general rules of drawing, using computer graphics; studying the basic principles and geometric modeling approach and methodology for developing applications with a graphical interface; developing skills in	5				V							



		using graphical systems to develop drawings, using 2D and 3D modeling methods												
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17	Fundamentals of railway transport	The discipline "Fundamentals of Railway Transport" is designed to obtain general ideas on engineering structures, technical devices and facilities, the main of which are: railway track, rolling stock (locomotives and wagons), locomotive and wagon facilities, signalling structures and devices, communications and computer technology, electricity and water supply, railway stations and nodes.	5						V	V				V
18	IT technologies on rolling stock	The history and prospects of IT development in railway transport. Description of information flows. Modern telecommunication systems and methods of data transmission over them. Data transmission networks of enterprises, road and interregional level. The contractor's arm. ARM of the depot attendant. Information flows of locomotive and wagon farms. The prospects of ASUT. The driver's electronic route. ARM of the master of the repair shop.	4					V						
19	Theoretical and applied mechanics	Theoretical and applied mechanics includes courses such as theoretical mechanics, theory of mechanisms and machines. Theoretical mechanics deals with the general laws of mechanical movements of material bodies and the mechanical interactions between them. In the theory of mechanisms and machines, general methods of research, construction, and kinematics of mechanisms and machines are studied. We also strive to involve students in the development and solution of tasks that help bridge the gap between scientific theory and engineering practice.	5		V									
20	Rolling stock and railway transport infrastructure	It consists of the following modules: general information about transport; track and track facilities; railway power supply; design features, technical characteristics of locomotives and wagons; locomotive, carriage facilities; rules of technical operation; automation, telemechanics and communication on the railway; organization of transportation and train movement.	6						V	V				
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		The discipline is aimed at the formation of professional competencies in the design of the operational fleet of rolling stock and technical requirements for railway infrastructure.												
21	Resistance of materials	Stretching and compression. Stresses in cross sections and deformations of a straight rod. Mechanical properties of materials under tension and compression. Calculation of tensile and compressive strength and stiffness. Geometric characteristics of flat sections. Shear and torsion. Calculation of strength and torsional stiffness. The bend. Normal and tangential bending stresses. Calculation of bending strength. Theory of stress and strain states. The hypothesis of the limit state. Difficult resistance. Stability of the equilibrium of deformable systems. Dynamic load.	5		V						V			
22	Standardization and certification of rolling stock	It consists of the following modules: standardization, certification, quality management. Studies the organizational and methodological foundations of metrological support in the development of requirements for ensuring traffic safety in transport and performing work on technical regulation in transport. Selects forms and schemes of certification of products (services) and processes, certification, using the regulatory framework, modern methods and information technologies.	5											V
23	Theory of machines and mechanisms	The main types of flat and spatial mechanisms. Structural synthesis and analysis of mechanisms. Kinematic analysis of mechanisms by graphical and analytical methods. Force analysis of mechanisms. Differential equations of motion of mechanisms and machines and methods of their solution. Balancing the mechanisms. General methods of synthesis (design) of mechanisms. Synthesis of plane and spatial lever mechanisms. Synthesis of gear mechanisms. Synthesis of cam mechanisms. Synthesis of manipulators and robots.	5		V									

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24	Hydraulics and hydraulic drive of vehicles	It consists of the following modules: hydrostatics, hydrodynamics, hydraulic drive, hydraulic machines. The basic concepts and fundamental laws of hydrostatics and hydrodynamics are studied. The issues of converting the	5								V			



		energy of the working medium into the mechanical energy of the movement of the working organs of machines are considered. Calculation of pipelines. Hydraulic machines and hydraulic drive of vehicles. Pumps and compressors. Regulating devices.												
25	Industrial economics	The purpose of mastering the discipline is to form knowledge of a comprehensive solution to economic problems of the development of economic activity of industrial enterprises, to acquire the ability to independently understand the changing market conditions. The economic aspects of product quality, investments, fixed and working capital of the enterprise, personnel, labor productivity, wages are studied. The main technical and economic indicators of production, assessment and analysis of the economic activity of the enterprise.	5									V		
26	Fundamentals of machine design and details	The purpose of the discipline is to form knowledge of the basics of theory, calculation and design of machine parts and assemblies. The general principles of design and construction, construction of models and calculation algorithms for typical machine parts, taking into account performance criteria, are considered. The types of failures of machine parts, the concept of reliability and its main indicators, the basics of the theory and methods of calculating typical machine parts, computer technologies for designing assemblies and machine parts are studied. Basic requirements for machine parts and assemblies.	5		V									

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27	Electrical engineering and the basics of electronics	The course forms knowledge in the field of fundamentals of the electromagnetic field, electric and magnetic circuits, DC, sinusoidal and non-sinusoidal current circuits, electric and magnetic fields, surface effects and proximity effects, electromagnetic shielding, electromagnetic devices and electrical machines; transformers, DC machines, asynchronous and synchronous machines; fundamentals of electronics, element bases of modern electronic devices; fundamentals of digital electronics, microprocessor tools, electrical measurement and instrumentation	5								V		V	



28	Labor protection	The purpose of the discipline is to form knowledge of legislative acts and norms aimed at ensuring occupational safety. In the discipline, students study legal and regulatory documents on occupational safety (OS), occupational hygiene and industrial sanitation. Dangerous and harmful production factors, safety measures during installation and operation of technological equipment, emergency situations and elimination of their consequences are considered. In the discipline, they study the basics of OS management, rationing, methods of assessing and forecasting OS, methods of monitoring and auditing OS.	5					V						
29	Dynamics of traction rolling stock	It consists of the following modules: dynamic system – "locomotive-path"; types of disturbances that cause vibrations of locomotives; methods for calculating and solving equations of crew vibrations; compilation of equations of vertical vibrations of simplified dynamic models; oscillations with random disturbances; lateral vibrations of locomotives; indicators of dynamic qualities of the mechanical part of locomotives; dynamic strength tests of locomotives. The discipline is aimed at developing skills for calculating the dynamic characteristics of locomotives.	4					V	V	V				

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30	Ground vehicles	It consists of the following modules: railway vehicles; road transport vehicles; water transport vehicles; air transport vehicles; means of mechanization of loading and unloading operations. The fundamentals of the design, device, principle of operation and basic technical characteristics of vehicles are studied; modern directions for improving their designs and ways to maintain their operability, methods for calculating the design, equipment and systems of vehicles.	5						V					
	The cycle of basic disciplines Component of choice													
31	Electrical equipment of locomotives	It consists of the following modules: general information, units of power systems of locomotives with a DC traction drive, AC rectifier systems, emergency modes and protection systems for power equipment, main circuits of the locomotive control system, electric locomotives,	5						V				V	



		microprocessor control and regulation system. The discipline allows you to master the methods of calculating the elements of electrical equipment, selecting electrical circuits for control circuits and protecting the electrical equipment of locomotives.												
32	Electric machines in land transport	It consists of the following modules: design, principle of operation, classification and characteristics of electric machines and transformers of general industrial use, equations of EMF, voltages, currents and torques, methods of starting and regulating the frequency of electric motors, physical working conditions, losses and efficiency. The course promotes the analysis of technical solutions to improve performance and the application of methods for calculating the parameters of electric machines of direct, alternating and three-phase currents.	5						V				V	

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33	Automation of technological processes of land transport	It consists of the following modules: automated process control systems; information systems of automated process control systems; fundamentals of modeling technological objects, controlled automated process control systems; structure and algorithms of process control, software control systems for production installations. The discipline forms the ability to solve problems of automation of production processes using modern technical means.	4					V						
34	Theory of automatic control in rolling stock	It consists of the following modules: fundamentals of automation of technological processes, the main tasks of the theory of automatic control, mathematical models of self-propelled guns, research methods for linear non-linear self-propelled guns, stability of automatic control systems, accidental impacts in linear self-propelled guns, optimal control problems, modern trends in the development of control systems.	4			V								
35	Fundamentals of railway rolling stock design	Basic concepts and parameters of raster and vector graphics. Classification of modern graphics processing software. Color representation in a computer. Fractals. Rasterization algorithms. Algorithms for processing bitmap images. Image filtering. Vectorization. Two-dimensional transformations. Transformations in space. 3D technology.	5		V			V						



		The main panels and advanced commands of the 3D drawing and graphics editor. The interface of the 3D program. Working with 2D drawing and 3D modeling teams.												
36	Design of transport facilities	The formation of students' competence within the framework of using the Compass 3D graphic editor in solving problems of designing transport facilities, as well as the ability to carry out project documentation. Knowledge of the technology of designing parts and structures in	5					V						V
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		of reference using specialized software and computer systems, computer skills as a means of information management.												
37	Non-destructive testing of rolling stock	It consists of the following modules: classification of defects in parts, types and methods of non-destructive testing; types of non-destructive testing; device, principle of operation, configuration of equipment used for non-destructive testing of rolling stock parts. The discipline forms: skills of working with diagnostic equipment for non-destructive testing; understanding and analyzing the results obtained; the ability to distinguish defects and choose rational methods of non-destructive testing for various parts of rolling stock.	6			V								V
38	Rolling stock technical diagnostics systems	It consists of the following modules: factors affecting the wear processes of parts; methods for diagnosing technical systems; methods for analyzing the technical efficiency of rolling stock and its equipment; mathematical basis for solving technical diagnostics problems. The discipline forms the ability to: plan work on the use of diagnostic complexes in the field of railway rolling stock; collect and analyze initial information data for the design of diagnostic tools and testing of rolling stock.	6					V	V					
	The cycle of core disciplines The university component													
39	Mechanical characteristics of engineering materials	Knowledge of the course will allow future bachelor's specialists to have information about modern engineering materials, about the characteristics, properties and methods of their determination; about the economic problems of using materials in the development and production of	5		V						V			



		machine-building products; about achievements and prospects for the use of nanomaterials.												
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40	Design and construction of locomotives	Comparative analysis of the design features and characteristics of various locomotive series; design, calculation and selection of optimal design options and technical parameters of modern locomotives; analysis of the working conditions of locomotive structural elements: mechanical parts, electrical equipment and electrical apparatus of locomotives, diesel and electric locomotives, auxiliary locomotive systems. Improving the design and technical parameters of locomotives using IT technologies, prospects for the development of locomotive construction in the Republic of Kazakhstan and abroad.	5			V			V					V
41	Locomotive repair and maintenance technology	The discipline is based on the requirements of regulatory and technical documents in the field of locomotive repair in the Republic of Kazakhstan. The discipline studies: Analysis of the causes of wear and damage to the main components of locomotives. The technology of repair of the main and auxiliary systems of locomotives. Repair and maintenance of electric locomotives. The technology of repair of the carriage of locomotives. Repair of electric locomotives. Methods of improving the locomotive repair and maintenance system.	6			V								V
42	Reliability of rolling stock	It consists of the following modules: basic concepts of reliability; non-recoverable systems; sequence of reliability assessment of devices of technical systems; functional and numerical indicators of reliability and maintainability of technical elements and systems; methods of analysis (calculation) of reliability of rolling stock; the main stages of calculating the reliability of devices and control systems in various types of failures; factors affecting the reliability of rolling stock; methods for improving the reliability of rolling stock.	4											V



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
43	Reliability and safety management in railway transport	The course is aimed at studying the methods and regulatory and technical framework for managing the functional safety and reliability of railway infrastructure facilities using a risk-based approach. As a result of studying the discipline, the undergraduate will be able to develop programs/strategies to ensure the safety and reliability of railway transport	4							V				V
The cycle of core disciplines Component of choice														
44	Theory of locomotive traction	The discipline studies: the theoretical foundations of the processes of traction force formation, methods for calculating the resistance to movement and braking of a train, the basic equation of train movement and methods for solving it, traction calculations, methods for rationing energy consumption by locomotives for train traction, rational train driving modes and features of heavy and long-component trains.	5							V				
45	Automatic braking of traction rolling stock	The content of the discipline is based on the requirements of regulatory and technical documents in the field of locomotive operation and ensuring transport safety on the railways of the Republic of Kazakhstan. Purpose and schematic diagrams of brakes, fundamentals of brake calculations, pneumatic part of the brake, power, control and braking devices, mechanical part of the brake, traffic safety devices and devices, brake repair and maintenance system in operation.	5						V	V				



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46	The air conditioning system in the wagons	It consists of the following modules: design features and technical characteristics of air conditioning systems in various passenger cars; sanitary and hygienic standards for passenger car air conditioning; thermal engineering qualities of the car body and its thermal balance; air ventilation in passenger cars; cooling; heating of passenger cars; water supply of passenger cars; air conditioning. The discipline is aimed at developing skills in theoretical and practical methods of calculating passenger car air conditioning systems.	4						V				V	
47	Traffic safety in railway transport	The basic concepts of the railway traffic safety system. Familiarization with measures to prevent and eliminate the consequences of emergencies, transport accidents and other events related to violations of traffic safety and operation rules on railway transport.	4							V				
48	Automated wagon design systems	The discipline is aimed at the formation of professional competencies in the field of the fundamental principles of computer-aided design of wagons. The discipline outlines the principles of automating the selection of optimal parameters of wagons and their linear dimensions, modern methods of developing design documentation and computer-aided design of wagons, their assemblies and parts. The discipline forms basic skills for improving the design of wagons using traditional and modern computer-aided design tools.	6					V						V

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49	Organization of locomotive operation and management of locomotive facilities	The discipline is based on the requirements of normative and technical documents in the field of locomotive operation and ensuring transport safety on the railway of the Republic of Kazakhstan. The discipline studies: the theoretical foundations and principles of labor organization of the locomotive fleet, the basics of scientific labor organization of locomotive crews, the basic principles of highly efficient use of locomotives and means for their maintenance, the basics of	6							V				V



		operation and maintenance locomotives, a methodology for calculating rolling stock utilization indicators.												
50	Electrical apparatus and electrical circuits of locomotives	The discipline consists of the following modules: general information about electric locomotives; locomotive relays, electromagnetic and electropneumatic contactors; general information about semiconductor and magnetic elements; General information about electrical circuits of traction rolling stock of railways; power excitation circuits of traction and auxiliary locomotive machines.	5					V	V				V	
51	Electric power transmission of locomotives	The purpose of studying the discipline is: familiarization with the principles of construction and operation, control of electric transmissions of locomotives, characteristics of electric transmissions and their elements; traction electric machines, electric energy converters; with the basics of calculation and testing of electric transmissions and their elements and determination of their technical and economic indicators.	5						V				V	
52	Power plants of locomotives	Analysis of the design features and principles of operation of power lines and its systems, theoretical foundations of thermodynamic processes occurring in power lines and their systems, methods for calculating the main indicators and components of the thermal balance of power lines, ways to increase the power of power lines, assessment of the efficiency of the fuel used, assessment of the influence of operational and climatic factors on power, fuel consumption and environmental indicators Power lines and ways to improve them. Improving the design and technical characteristics of power lines.	5						V					V
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
53	Locomotive control systems and circuits	The course examines the basic devices of traction devices and electrical equipment of locomotives, description of electromagnetic processes in power circuits and control circuits of a locomotive, analysis and calculation of the main parameters of electrical devices, calculation and design of electrical circuits, comparative analysis of control systems of locomotives of various series; block diagrams of automatic locomotive speed control systems; microprocessor control systems; calculation methods and design of control systems.	5					V	V					



54	Theory and practice of project management	The discipline is aimed at studying the general trends of project management in market conditions in order to increase productivity in the professional industry. The essence, concept, composition, tasks and problems of management. The study of the scientific methodology of project management. The concept of organization, the external and internal environment of the team, communication. Requirements for project management. The role of decision-making in project management. The concept of anti-crisis programs in the performance of managerial functions. The concept of management culture and professional etiquette	5										V		
55	The technology of designing and calculating the design of locomotives	The discipline consists of the following modules: the main types of traction rolling stock and its classification; the history and trend of locomotive construction in the Republic of Kazakhstan; the stages of design and calculation of locomotives; selection of traction equipment and calculation of traction and economic characteristics; basic principles of locomotive layout and distribution.	5					V	V						

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
56	Technological design of locomotive enterprises	The discipline consists of the following modules: classification of enterprises for the repair and operation of locomotives; regulatory documents for the design of buildings and structures of the locomotive industry; selection of the main sizes of sections of the depot stall and crane capacity; calculation of the number of stalls for locomotives; design and calculation of the parameters of sections and departments of the depot.	5					V						
57	Automation and automation of locomotives	The purpose of the study is to form the student's competencies in the field of operation, repair and maintenance of traction and auxiliary electrical equipment of locomotives necessary for operation, maintenance, design, production, testing, modernization of autonomous traction rolling stock, as well as in the development of means and ways to improve operational and repair characteristics (efficiency, reliability, longevity) traction rolling stock.	5		V							V		



58	Automatic control of electric power transmission	The discipline aims to study by students the basic methods of controlling electric power transmissions of locomotives, the principles of their automation and construction, operation and calculation; the study of the device and characteristics of electric transmission elements of locomotives: torque and frequency converters, traction electric machines, electric energy converters based on a systematic approach and the principle of continuity of education provided by the curriculum.	5										V	V
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The discipline module of the Xi'an Railway Vocational Institute Component of choice														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
59	International Chinese Language Courses	The aim of the course is to make Chinese easy to learn. The course content is divided into knowledge of the Chinese language, synthesis of the Chinese language, reading and writing in Chinese, development of bachelor's communication skills using oral Chinese, use of reading and writing skills. The structure of this content is "profession", "hobby", "food", "travel", "education".	15	V										
60	Electronics	The course studies: power electronic components and their characteristics; the structure, principles and application of phase-controlled rectification electrical circuits, rectification circuits, active inverted, passive inverted, trigger and other rectification circuits on locomotives; methods for calculating the power coefficient; methods of applying PWM control technology in the field of power electronics.	2,5								V		V	
61	Electrical control and PLC	The course studies: low voltage electrical appliances, typical control lines, typical methods of analysis and design of electrical control systems; programmable controllers (principles of operation of programmable controllers, command systems, programming methods, wiring installation, communication, etc.). Master the principles and methods of electrical control and application skills-PLC research through training and hands-on training.	2,5										V	



62	Engineering Graphics and CAD	Main content: Relevant provisions of national standards for mechanical drawings, basic theories and methods for constructing and reading drawings, including: fundamentals of drawings; fundamentals of the projection method; method of drawing on axes; projection combinations, basic ways of expressing parts; drawings of parts and assembly drawings, as well as the basics of AutoCAD drawings.	1,5				V							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
63	Fundamentals of engineering mechanics	The main content of the course: theoretical mechanics and mechanics of materials for stress analysis of simple parts and components, methods for calculating their strength, stiffness and stability; basic knowledge of general types, characteristics, methods of forming and processing engineering materials; basic knowledge of principles, characteristics, standards, general design methods, principles and characteristics of mechanical drives.	1,5		V									
64	Fundamentals of electrical engineering and electronics	The study of the basic physical characteristics of circuits, circuit elements, methods of analysis of DC circuits, sinusoidal AC circuits and analysis, three-phase AC circuits, magnetic paths and transformers, understanding of first-order dynamic circuits. Diodes and circuits, integrated transport and application circuits, AD converters, basic logic relationships, analysis and design of combined logic circuits,	3								V		V	
65	Practical training of mechanical fitters	Acquisition of skills in using various measuring tools and clamps, pliers.	1			V								
66	Practical training in the basics of electrical engineering and electronics	Acquisition of skills: installation of a multimeter, use of electrical measuring instruments and instruments. The study of sinusoidal AC circuits, three-phase AC circuits, their characteristics, measurements of electronic components of electrical equipment. Studying the technology of welding training circuits and assembling radios.	1								V		V	



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
67	The general course of the railways	Main content: the history of the development of railways, the status of the railway transport industry, the infrastructure and rolling stock of railway transport and the working processes of railway transport and other basic concepts, basic principles and basic regulations. The course forms an understanding of the trend in the development of railway transport, introduces the development of high-speed rail and freight transport, as well as railway rolling stock.	1						V	V				V
68	Physical Culture	General physical training (development of physical qualities). When planning the material of the practical section, it is recommended to use the following means for the development of physical qualities: such as speed, endurance, flexibility, dexterity, strength. Special physical training. To choose the means of special physical training, various exercises can be used in terms of organization, methodological support, taking into account the region, sports and outdoor games.	4	V										
69	Maintenance and repair of electric motors and electrical equipment of locomotives	The main content: 1. Study of the structural composition, function, principle of operation and basic parameters and technology of maintenance and repair of traction electric machines of direct and alternating current. 2. Study of the structural composition, function, principle of operation and basic parameters and technology of maintenance and repair of electric equipment of locomotives.	3			V			V					

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
70	Maintenance and repair of main and auxiliary equipment of locomotives	This course studies the design and layout of the main and auxiliary equipment of locomotives; rules for the maintenance and repair of locomotives; methods of non-destructive testing of railway rolling stock; technology for inspecting locomotives and determining equipment malfunctions, setting maximum defective sizes.	2,5			V			V					V



71	Adjustment and maintenance of the locomotive control system	<p>The course examines the classification, composition and principles of electric circuits of locomotives, in order to analyze the electric circuits of locomotives, introduces the test procedures of locomotives to identify and eliminate common faults of locomotives.</p> <p>The course is based on the application of communication and network technologies, intelligent locomotive control systems, including common standards, functions, topology and principles of locomotive networks, such as IS and Lonworks.</p>	3			V			V				V	
72	Maintenance and repair of the locomotive brake system	<p>The main content:</p> <p>1. Study of the structural composition, function, principle of operation and basic parameters and technology of maintenance and repair of brake equipment such as DK-1, CCB-II, JZ-7.</p> <p>2. Study of the structural composition, function, principle of operation and basic parameters and technology of maintenance and repair of brake equipment of locomotives.</p>	3			V			V					V
73	Basics of locomotive driving	Acquisition of practical skills in driving a locomotive according to the standardized workflow of locomotive management. Driving technology and technical processes (acceptance and dismissal, acceptance-delivery of the locomotive, departure of the train, testing of brakes, departure from the depot, driving the train along the section, abnormal driving).	1							V				
74	Fundamentals of a microprocessor-based locomotive control system	The study of communication technology inside the locomotive, network technologies, intelligent control, including common standards, functions, topology and principles of operation of the locomotive network, such as IS and Lonworks. Familiarization of students with the use of a microprocessor-based locomotive control system and ways to eliminate common malfunctions during operation of the locomotive control system.	1,5					V		V				
75	Traffic safety and locomotive braking equipment	The course examines the composition, functions and methods of using train safety and control devices, on-board locomotive protection systems, remote diagnosis systems for locomotives (CMD), integrated	2,5					V		V				



		wireless communication equipment for locomotives (CIR), train safety alarm devices (LBJ), derailment devices, alarm and monitoring systems for wireless shunting locomotives (STP), portable terminals of railway mobile communication systems (GSM-R), locomotive signals.												
76	Magnetic suspension with linear drive	This course studies the design and layout, the principle of operation of a rolling stock on magnetic suspension, and the device of a magnetic circuit. To familiarize students with the theory of levitation.	1,5							V			V	
77	On-board diagnostic systems of locomotives	The main content: He mainly studies the structure, types, performance characteristics and application of sensors for detecting malfunctions of locomotive equipment, the main types of on-board diagnostic systems of locomotives.	1,5			V			V					V
78	Locomotive power plants of locomotives and their management	Main content: classification, design and principle of operation of diesel engines and auxiliary systems. It is aimed at developing skills for checking and eliminating major malfunctions of locomotive power plants and auxiliary systems.	2,5						V					V
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
79	Electric rolling stock	Main content: The course comprehensively provides basic knowledge of the design, layout, principle of operation and technical characteristics, technology of operation of modern electric trains, prospects for the development of electric traction.	1,5						V	V				
80	Urban rail vehicle driving technologies	Main content: The study of the main functions of controlling the motor car rolling stock of the metro, including train preparation, entrance and exit from the depot, depot operation, main line management, platform operation, return work, etc.;	1,5							V				
81	Intelligent manufacturing technologies	Main content: Introduction to the overview of intelligent manufacturing technologies, intelligent design technologies, intelligent processing technologies, intelligent monitoring and control of processing processes, intelligent production systems, intelligent production equipment, artificial intelligence. The status quo and the development of advanced production and maintenance of rolling stock for student education.	2,5			V		V		V				



82	Driving Psychology	Main content: Basic knowledge about the principles of psychology of driving a locomotive crew, psychological regulation, mental health, etc. To inform students about the importance of mental health, to master general methods of psychological regulation and control, to form awareness and skills for conscious maintenance of mental health, thereby constantly improving the psychological qualities of driving.	1,5	V							V				
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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
83	Train traction theory	Main content: Study of the basics of the theory of locomotive traction: forces acting on the train, solving the basic equation of train movement, safety, energy efficiency and reliability of locomotive traction. Familiarization of students with the traction characteristics of locomotives, mastering the patterns of changes in the resistance and braking force of trains, mastering methods for calculating the speed and time of train movement, mastering methods of traction calculations and energy consumption of locomotives.	1,5							V				
84	Locomotive repair technology	The study of systems for organizing maintenance and repair of locomotives; methods and technological processes for repairing locomotives and main equipment; principles and grounds for drawing up a repair plan. Safety rules during repair work. Providing students with the basic knowledge and skills necessary for the repair of railway rolling stock in this specialty.	1,5			V								V




#### **4.4 Information about modules/disciplines (if there are modules, you need to highlight them)**

Name of the module	The volume of credits of the module
M1 – Language training module	10
M2 – Physical training module	8
M3 – Information Technology Module	5
M4 – The module of socio-cultural development	18
M5 – Module on the basics of anti-corruption culture, ecology and life safety	5
M6 – Module of physical and mathematical training	15
M7 – Basic (engineering) training module	92
M8 - Professional activity module	64



## 5. The curriculum of the educational program

KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY named after K.SATBAYEV																			
 SATBAYEV UNIVERSITY																			
CURRICULUM of Educational Program on enrollment for 2023-2024 academic year																			
Educational program 6807134 - Technology of production, repair and operation of locomotives Group of Educational programs: D065 - "Transport equipment and technologies"																			
Form of study: full-time		Duration of study: 4 years		Academic degree: Bachelor of Engineering and Technology															
Discipline code	Name of disciplines	Cycle	Total amount in credits	Total hours	classes in volume of lecture	SIS (credits in hours)	Form of control	Allocation of face-to-face training based on courses and semesters											
								I course		II course		III course		IV course					
								1	2	3	4	Semester I	Semester II	Semester III	Semester IV				
CYCLE OF GENERAL EDUCATION DISCIPLINES (GED)																			
M-1. Module of language training																			
LNG008	English language	GED, BC	18	280	0006	218	E	8	3										
LNG004	Kazakh (Russian) language	GED, BC	18	360	0006	218	E	2	3										
M-2. Module of physical training																			
KFK01-024	Physical Culture	GED, BC	6	240	0018	138	Classroom	2	2	2	2								
M-3. Module of information technology																			
CSB677	Information and communication technologies (in English)	GED, BC	5	180	2116	168	E				3								
M-4. Module of socio-cultural development																			
HEM017	History of Kazakhstan	GED, BC	5	180	1002	168	SE	3											
HEM032	Philosophy	GED, BC	5	180	1402	168	E				3								
HEM020	Socio-political knowledge module (sociology, politicalology)	GED, BC	3	90	1401	80	E				3								
HEM034	Socio-political knowledge module (sociology, politicalology)		5	180	2001	168	E				3								
M-5. Module of anti-corruption culture, ecology and life safety base																			
M004 200	Fundamentals of scientific research methods	GED, CCH	9	180	2001	168	E												
HEM 116	Fundamentals of anti-corruption culture																		
M002400	Fundamentals of Economics and Entrepreneurship											3							
CSB680	Ecology and life safety																		
CYCLE OF BASIC DISCIPLINES (BD)																			
M-6. Module of physical and mathematical training																			
MAT 011	Mathematics I	BD, UC	5	150	1402	168	E	3											
MAT 008	Physics	BD, UC	5	150	1111	200	E	3											
MAT 002	Mathematics II	BD, UC	5	150	1402	200	E		3										
M-7. Module of basic training																			
GEH 029	Engineering and computer graphics	BD, UC	5	150	1111	200	E	3											
TRAS29	Fundamentals of railway transport	BD, UC	5	120	2001	75	E	3											
TRAS26	IT technologies on rolling stock	BD, UC	4	150	2001	100	E		4										
GEN411	Theoretical and applied mechanics	BD, UC	5	150	2110	168	E				3								
TRAS60	Rolling stock and railway transport infrastructure	BD, UC	6	180	2002	120	E				3								
GEN408	Strength of materials	BD, UC	5	150	1111	168	E				3								
TRAS25	Standardization and certification of rolling stock	BD, UC	3	150	2001	100	E				3								
GRN117	The theory of machines and mechanisms	BD, UC	5	150	2110	168	E				3								
TRAS82	Hydraulics and hydraulic drive of vehicles	BD, UC	3	150	2001	100	E				3								
DSR143	Industrial economics	BD, UC	3	120	2001	100	E				3								
GEN125	Basics of designing and details of cars	BD, UC	5	150	1111	168	E				3								
TRAS458	Electrical engineering and electronics Fundamentals	BD, UC	5	150	1111	168	E				3								
SAF110	Life protection	BD, UC	3	150	1002	168	E				3								
TRAS27	Dynamics of traction rolling stock	BD, UC	4	120	2001	75	E				4								
TR18	Electric	BD, CCH	3	150	2001	168	E				3								
TRAS81	Ground vehicles	BD, UC	5	150	2001	168	E					3							
TR20	Electric	BD, CCH	5	150	2001	168	E					3							
TR21	Electric	BD, CCH	5	150	2001	168	E					3							
TR22	Electric	BD, CCH	6	180	1002	120	E						3						
AAZ170	Educational practice	BD, UC	2						2										
CYCLE OF PROFILE DISCIPLINES (PD)																			
M-8. Module of professional activity																			
TRAS82	Mechanical characteristics of engineering materials	PD, UC	3	150	2110	168	E							3					
TRAS90	Design and construction of locomotives	PD, UC	5	150	2001	168	E							3					
TRAS10	Locomotive repair and maintenance technology	PD, UC	6	180	2102	120	E							6					
TRAS98	Reliability of rolling stock	PD, UC	4	120	2001	75	E						4						
TRAS14	Electrical equipment of locomotives	PD, UC	4	120	2001	75	E								4				
TR18	Electric	PD, CCH	3	150	2001	168	E						3						
TR18	Electric	PD, CCH	4	120	2001	75	E						4						
TR18	Electric	PD, CCH	6	180	2001	120	E							6					
TR18	Electric	PD, CCH	3	150	2001	168	E							3					
TR18	Electric	PD, CCH	5	150	2001	168	E								5				
TR18	Electric	PD, CCH	3	150	2001	168	E								3				
TR18	Electric	PD, CCH	3	150	2001	168	E								3				
AAZ141	Production practice I	PD, UC	2								2								
AAZ141	Production practice II	PD, UC	3										3						



M-9. Module of final orientation												
ELC108	Final examination	FA	8									8
M-10. Module of additional types of training												
AAFT04	Library studies	ATT	0									
Total based on UNIVERSITY:										31	28	59
										64	60	124

Xian Railway Vocational Institute												
ENG123	International Chinese Language Courses	PD, CCH	1.5	400	2001		2	35				
ELC027	Electronics	PD, CCH	2.5	75	2001		2		2.5			
ELC028	Electrical control and PLC	PD, CCH	2.5	75	2001		2		2.5			
SCM111	Engineering Graphics and CAD	PD, CCH	0.5	45	2001		2		1.5			
GB0041	Fundamentals of engineering mechanics	PD, CCH	0.5	45	2001		2		1.5			
ELC029	Fundamentals of electrical engineering and	PD, CCH	2	90	2001		2		2			
TL118	Practical training of mechanical design	PD, CCH	1	30	2001		2		1			
ELC030	Theoretical training in the basics of electronics	PD, CCH	1	30	2001		2		1			
TL119	The general course of the railway	PD, CCH	1	30	2001		2		1			
AAFT06	Physical Culture I	PD, CCH	4	120	2001				4			
TL101	Maintenance and repair of electric motors	PD, CCH	3	90	2001		2		3			
TL104	Maintenance and repair of axles and axles	PD, CCH	2.5	75	2001		2		2.5			
TL106	Adjustment and maintenance of the motor	PD, CCH	3	90	2001		2		3			
TL102	Maintenance and repair of the locomotive	PD, CCH	3	90	2001		2		3			
TL103	Practical training of locomotive driving	PD, CCH	1	30	2001		2		1			
TL105	Fundamentals of a microcomputer-based	PD, CCH	2.5	45	2001		2				0.5	
TL107	Traffic safety and locomotive equipment	PD, CCH	2.5	75	2001		2				2.5	
TL108	Magnetic suspension rail line driver	PD, CCH	0.5	45	2001		2				0.5	
TL109	On-board diagnostic systems of locomotives	PD, CCH	0.5	45	2001		2				0.5	
TL110	Locomotive control system of magnetic rail	PD, CCH	2.5	75	2001		2				2.5	
TL111	Electric railway track	PD, CCH	0.5	45	2001		2				0.5	
TL112	Urban rail vehicle driving technology	PD, CCH	0.5	45	2001		2				0.5	
TL113	Locomotive manufacturing technology	PD, CCH	2.5	45	2001		2				2.5	
TL114	Driving Technology	PD, CCH	0.5	45	2001		2				0.5	
TL115	Train operation theory	PD, CCH	0.5	45	2001		2				0.5	
TL116	Locomotive repair technology	PD, CCH	0.5	45	2001		2				0.5	
Total on UNIVERSITY:										17	16	33
										31	34	65

Number of credits for the entire period of study				
Cycles of disciplines		Credits		
Cycle code		required component (RC)	optional component (OC)	Total
002	Cycle of general education disciplines	11	3	14
10	Cycle of basic disciplines	51	21	72
10	Cycle of professional disciplines	22	22	44
Total for theoretical training:		84	46	130
15	Final examination	8		8
TOTAL:		92	46	138

Decision of the Academic Council of Kunming Railway Vocational Institute, Protocol No. 5, dated 24.11.2023.

Decision of the Educational and Methodological Council of Kunming Railway Vocational Institute, Protocol No. 3, dated 12.11.2023.

Decision of the Academic Council of the Institute, E&ME, Protocol No. 2, dated 10.10.2023.

Vice-Rector for Academic Affairs

Director of Institute of E&ME

Head of department TM&T

Representative of the Council from employers

B.A. Baidarov

K.K. Yelmenov

S.A. Bortolov

B.D. Zhuravskiy



## **6. Additional educational programs (Minor)**

Missing