First deputy director for operations of the branch of «NC «Kazakhstan railways» JSC – «Almaty branch of the backbone network»

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CATALOGUE OF ELECTIVE COMPONENT DISCIPLINES

EDUCATIONAL PROGRAM **6B07336 – Railway construction**

Education level: bachelor's degree **Duration of study: 3 years** **Year of admission: 2025**

Cycle	Component	Discipline name	Total workload		Trimester	Learning outcomes	Brief description of the discipline	Prerequisites	Postrequisites
			in academic hours	in academic credits					
1	2	3	4	5	6	7	8	9	10
GES	KV	Environmentally sustainable technologies	150	5	5	LO6,7	The discipline "Environmentally sustainable technologies" studies modern methods and innovative solutions aimed at minimizing the negative impact of human activities on the environment. The course examines the principles of sustainable development, energy-saving technologies, renewable energy sources, waste management strategies, and environmentally sound production processes.	The history of Kazakhstan, Kazakh (russian, foreign) language, Sociology, Cultural studies, Construction chemicals	Philosophy, Political science, Professionally oriented foreign language, Occupational safety and health, Final certification
		Green economy and sustainable entrepreneurship				LO6	The discipline "Green Economy and Sustainable Entrepreneurship" is devoted to the study of environmentally oriented economic models and business strategies aimed at sustainable development. The course examines the concepts of the green economy, ESG (Environmental, Social, Governance) approaches, circular economy, sustainable business models and their impact on global markets.	The history of Kazakhstan, Kazakh (russian, foreign) language, Sociology, Cultural studies	Philosophy, Political science, Professionally oriented foreign language, Managerial economics, Time management, Estimated pricing in architecture and construction, Occupational safety and health, Organization and planning of railway construction, Organization of construction production, Final certification

		Fundamentals of financial literacy				LO5,6	The discipline is aimed at developing the ability to make informed financial decisions, plan income and expenditures, assess risks and effectively manage their resources in a market economy. It studies the basic knowledge in the sphere of finance and rational management of monetary resources, the concepts of financial system, budget, banking products, crediting, savings, investments, insurance, taxation and protection against financial fraud are considered.	The history of Kazakhstan, Kazakh (russian, foreign) language, Sociology, Cultural studies	Philosophy, Political science, Professionally oriented foreign language, Managerial economics, Time management, Estimated pricing in architecture and construction, Organization and planning of railway construction, Organization of construction production, Final certification
		Digital inclusion				LO4	The discipline "Digital Inclusion" is devoted to the study of the principles of ensuring equal access to digital technologies and information for all social groups, including people with disabilities. The course examines barriers to digital inequality, strategies for overcoming them, technologies for adapting the digital environment, and government initiatives to develop an inclusive digital society.	Engineering mathematics 1,2, Construction physics, Information and communication technologies, Basics of Python programming, Engineering graphics and computer modeling	Information modeling technology in architecture and construction, Final certification
		Basics of law and anti-corruption culture				LO9	The discipline outlines the fundamental concepts of law, the constitutional structure of the state power of the Republic of Kazakhstan, the rights and freedoms of citizens enshrined in the Constitution, the mechanism and protection of legitimate human interests in case of their violation. The discipline forms students' improvement of public and individual legal awareness and legal culture, as well as a system of knowledge and citizenship on combating corruption as an antisocial phenomenon.	The history of Kazakhstan, Kazakh (russian, foreign) language, Sociology, Cultural studies	Philosophy, Political science, Professionally oriented foreign language, Final certification
BD	KV	Theoretical mechanics	120	4	1	LO1,2	Formation of scientific engineering thinking. To familiarize with the basic concepts, laws and theorems that make it possible to compose equations describing the behavior of mechanical systems, the ability to record a specific phenomenon in mathematical form, the use of basic methods of mechanics in the	Basic school knowledge in mathematics and physics	Engineering mathematics 2, Resistance of materials, Applied mechanics, Construction mechanics, Mechanics of structural strength, Building constructions, Final

							study of motion and equilibrium of mechanical systems in the study of disciplines of the professional cycle.		certification
		Fundamentals of classical mechanics				LO1,2	The discipline aims to develop skills in solving problems and the ability to analyze and solve tasks in the field of statics and dynamics of rigid bodies and oscillatory motion, studying the main mathematical models used in theoretical mechanics, kinematic characteristics of the motion of material points and systems, solving statics problems using equilibrium conditions of force systems, and dynamics based on Newton's second law with the application of fundamental theorems of dynamics.	Basic school knowledge in mathematics and physics	Engineering mathematics 2, Resistance of materials, Applied mechanics, Construction mechanics, Mechanics of structural strength, Building constructions, Final certification
BD	KV	Resistance of materials	150	5	2	LO1,2	Formation of fundamental knowledge in the field of calculations of structural elements for strength, stiffness and stability, mastering the calculation and experimental foundations and practical methods of calculation of structures under the condition of reliability, durability, efficiency, considering the mechanical properties of structural materials and the ability to design by strength criteria correctly evaluating the limiting state, conducting verification and design calculations, using modern educational and information technology.	Engineering mathematics 1, Construction physics, Theoretical mechanics, Fundamentals of classical mechanics	Construction mechanics, Mechanics of structural strength, Building constructions, , Railway track 1,2,3, A seamless path, Bridges and tunnels on railways, Artificial structures on railways, Final certification
		Applied mechanics				LO1,2	This discipline develops practical skills in applying the laws of theoretical mechanics and strength of materials to calculate the strength, stiffness, and stability of machine elements and engineering structures, as well as to analyze their motion and interaction under various types of loads, with the aim of further designing reliable and efficient technical systems.	Engineering mathematics 1, Construction physics, Theoretical mechanics, Fundamentals of classical mechanics	Construction mechanics, Mechanics of structural strength, Building constructions, , Railway track 1,2,3, A seamless path, Bridges and tunnels on railways, Artificial structures on railways, Final certification
BD	KV	Construction mechanics	150	5	3	LO1,2	Formation of skills in designing standard structures related to the choice of a design	Engineering mathematics 1,2, Construction physics,	Building constructions, Railway track 1,2,3, A seamless

							scheme, determining the most loaded structural elements and calculating internal forces and stresses. Studies methods for calculating forces in statically definable and indeterminate rod systems under the action of constant and temporary loads, determining displacement in rod systems to ensure the strength and reliability of structures in combination with high efficiency.	Theoretical mechanics, Fundamentals of classical mechanics, Resistance of materials, Applied mechanics, Building materials	path, Bridges and tunnels on railways, Artificial structures on railways, Minor program 1, Final certification
		Mechanics of structural strength				LO1,2	Formation of skills in the field of work analysis and calculation of structures made of various materials under various influences using modern computing equipment. Studies the features of the laws of stress and strain distribution in structural elements under various conditions of external load, principles and methods of static and dynamic calculation of engineering structures for strength, rigidity, stability.	Engineering mathematics 1,2, Construction physics, Theoretical mechanics, Fundamentals of classical mechanics, Resistance of materials, Applied mechanics, Building materials	Building constructions, Railway track 1,2,3, A seamless path, Bridges and tunnels on railways, Artificial structures on railways, Minor program 1, Final certification
BD	KV	Geology and soil mechanics	150	5	4	LO3	The discipline studies the basic principles and methods of geology necessary for assessing geological and hydrogeological conditions during the design, construction and operation of engineering structures, including the assessment of the physical and mechanical properties of soils and rocks, as well as the influence of geological factors on the construction and operation of facilities.	Construction chemicals, Building materials	Bases and foundations, Geotechnics in foundation engineering, Hydraulics, hydrology, hydrometry, Hydraulic engineering calculations and measurements, Railway track 3, Bridges and tunnels on railways, Artificial structures on railways, Final certification
		Geoinformation systems in geology				LO3,5	He studies geographic information systems (GIS) in geology, describes methods for processing and analyzing geospatial data. The application of GIS for mapping, modeling and forecasting of geological processes is considered.	Construction chemicals, Building materials	Bases and foundations, Geotechnics in foundation engineering, Hydraulics, hydrology, hydrometry, Hydraulic engineering calculations and measurements, Railway track 3, Bridges and tunnels on railways, Artificial structures on railways, Final certification

BD	KV	Bases and foundations	150	5	5	LO3	Formation of knowledge about the basic laws of soil behavior under load, the theory of stress-strain state and their interaction with structures. Studies the main methods for determining the sediment of foundations, the stability of slopes and slopes, as well as the morphology, dynamics and regional features of the upper horizons of the Earth's crust (lithosphere) and their relationship with engineering structures	Construction chemicals, Building materials, Building constructions, Geology and soil mechanics, Geoinformation systems in geology	Hydraulics, hydrology, hydrometry, Hydraulic engineering calculations and measurements, Railway track 3, Bridges and tunnels on railways, Artificial structures on railways, Final certification
		Geotechnics in foundation engineering				LO3	Formation of knowledge about the basic laws of soil behavior under load, the theory of stress-strain state and their interaction with structures. He studies the basic methods for determining the sedimentation of foundations, the stability of slopes and slopes, as well as the morphology, dynamics and regional features of the upper horizons of the Earth's crust (lithosphere) and their relationship with engineering structures. It is important to correctly determine the physical, mechanical, and hydrological properties of the soils at the construction site (density, strength, subsidence, groundwater level, seismic activity, and other characteristics).	Construction chemicals, Building materials, Building constructions, Geology and soil mechanics, Geoinformation systems in geology	Hydraulics, hydrology, hydrometry, Hydraulic engineering calculations and measurements, Railway track 3, Bridges and tunnels on railways, Artificial structures on railways, Final certification
BD	KV	Hydraulics, hydrology, hydrometry	120	4	7	LO3	The course of the discipline "Hydraulics, hydrology, hydrometry" includes the study of the movement and equilibrium of liquids, the laws and characteristics of their manifestation, water processes and modes of water flows, methods for determining water parameters. The theoretical set of knowledge is applicable in the design of transport structures, as well as in hydraulic engineering construction.	Construction chemicals, Geology and soil mechanics, Geoinformation systems in geology, Bases and foundations, Geotechnics in foundation engineering, Railway track 1	Maintenance and repair of railway track 1,2, Final certification
		Hydraulic engineering calculations and measurements				LO3	The discipline "Hydraulic calculations and measurements" studies methods for calculating water flow rates, head, filtration	Construction chemicals, Geology and soil mechanics, Geoinformation systems in	Maintenance and repair of railway track 1,2, Final certification

							and stability of culverts in the design of transport structures. The course covers methods for measuring hydrological characteristics, analysis of field studies, modeling of processes in river beds, calculation of culverts and protective structures.	geology, Bases and foundations, Geotechnics in foundation engineering, Railway track 1	
BD	KV	Managerial economics	90	3	6	LO6	Formation of the conceptual apparatus and development of skills of economic analysis using modern models and patterns of economic science, consideration of economic problems and challenges facing the head of the firm. The study of this discipline will allow students to obtain and develop knowledge in the field of analytical research of economic, technological and technical parameters of the enterprise, as well as allow you to master the skills of using special methods of economic justification of management decisions and assessment of their consequences.	Green economy and sustainable entrepreneurship, Fundamentals of financial literacy, Fundamentals of railway design, Railway surveys and design	Estimated pricing in architecture and construction, Organization and planning of railway construction, Organization of construction production, Final certification
		Time-management				LO6	The discipline studies a system of methods, tools and approaches that are aimed at effective time management in order to achieve set goals. The course is designed to improve skills in organizing and optimizing the use of working time, increasing productivity, reducing stress, planning, delegation, using tools and technologies, as well as knowing your time and energy rhythms in order to use your time effectively.	Green economy and sustainable entrepreneurship, Fundamentals of financial literacy, Fundamentals of railway design, Railway surveys and design	Estimated pricing in architecture and construction, Organization and planning of railway construction, Organization of construction production, Final certification
PD	KV	Computer-aided design of railways	120	4	8	LO4	This discipline studies the application of modern computer technologies and software for the design, planning, and management of railway infrastructure, being a key part of educational programs related to transport construction.	Basics of Python programming, Engineering geodesy, Educational practice (geodetic), Fundamentals of railway design, Railway surveys and design, Reconstruction of railways, Minor program 1	Final certification, Basic and profile disciplines of the master’s degree
		Automated railway				LO4	The discipline studies specialized software	Basics of Python programming,	Final certification, Basic and

		track design systems					systems used to automate the design and calculation of railway tracks and infrastructure elements, allowing to speed up design processes, increase accuracy, reduce errors, and apply modern CAD systems both for new projects and to optimize existing solutions.	Engineering geodesy, Educational practice (geodetic), Fundamentals of railway design, Railway surveys and design, Reconstruction of railways, Minor program 1	profile disciplines of the master's degree
PD	KV	Bridges and tunnels on railways	120	4	7	LO 2,3,10	Purpose of the discipline is to form knowledge on acquiring skills in the maintenance and repair of bridges and tunnels on railways. Studies regulatory and technical documents, guidelines, various calculation methods for bridge and tunnel structures, ways to maintain them, defects and deformations of bridges and tunnels, and individual parts of structures to eliminate them to ensure uninterrupted operation of the line.	Resistance of materials, Applied mechanics, Construction mechanics, Mechanics of structural strength, Geology and soil mechanics, Geoinformation systems in geology, Bases and foundations, Geotechnics in foundation engineering, Building materials, Building constructions, Fundamentals of railway design, Railway track 1,2	Maintenance and repair of railway track 1,2, Final certification
		Artificial structures on railways				LO 2,3,10	This discipline includes the study of various structures and facilities that ensure the functioning of the railway track and infrastructure, which play a key role in ensuring the safety, reliability, and durability of railway transportation.	Resistance of materials, Applied mechanics, Construction mechanics, Mechanics of structural strength, Geology and soil mechanics, Geoinformation systems in geology, Bases and foundations, Geotechnics in foundation engineering, Building materials, Building constructions, Fundamentals of railway design, Railway track 1,2	Maintenance and repair of railway track 1,2, Final certification
PD	KV	Track, construction machinery and equipment	120	4	8	LO8	The purpose of the discipline is to study the structures of track and construction machinery and equipment. Forms knowledge on the technical capabilities of small-scale mechanization, energy supply of track and construction, loading and unloading	Railway construction technology, Technological processes of railway construction	Maintenance and repair of railway track 2, Final certification

							machines and mechanisms when used for updating, repairing and current maintenance of the upper structure of the track and small artificial structures.		
		Machines and mechanisms in the travel industry				LO8	The purpose of the discipline: to prepare students for production activities in the field of mechanization and automation of repair, construction and current maintenance of railway tracks using track machines and mechanisms, the study of types, technical and dimensional parameters and design of track machines and mechanisms, their scope of application	Railway construction technology, Technological processes of railway construction	Maintenance and repair of railway track 2, Final certification
PD	KV	Railway construction technology	180	6	7	LO 7,8,10	The study of the basic principles of technology and mechanization of railway construction, the composition of construction works and processes, methods of designing and developing technological processes for the construction of railway tracks, laying tracks, ballasting tracks, and the construction of contact network supports for electrified sections of the backbone network.	Railway surveys and design, Railway track 1,2	Occupational safety and health, Organization and planning of railway construction, Organization of construction production, Maintenance and repair of railway track 1,2, Track, construction machinery and equipment, Machines and mechanisms in the travel industry, Regulatory and technical documentation in railway construction and track facilities, Minor program 2, Final certification
		Technological processes of railway construction				LO 7,8,10	The discipline studies the technological processes performed during the construction of railways, methods and means for the effective performance of work, including preparation, laying of tracks, construction of structures, organization, planning, control of construction operations, as well as safety and compliance with regulatory requirements.	Railway surveys and design, Railway track 1,2	Occupational safety and health, Organization and planning of railway construction, Organization of construction production, Maintenance and repair of railway track 1,2, Track, construction machinery and equipment, Machines and mechanisms in the travel industry, Regulatory and technical documentation in railway construction and track

									facilities, Minor program 2, Final certification
PD	KV	Organization and planning of railway construction	150	5	8	LO 7,8,10,11	The discipline studies advanced technologies and the organization of construction and installation works aimed at reducing material and energy costs while complying with standards and technical regulations. The stages of preparatory and basic work, the procedure for putting facilities into operation, as well as the calculation of resource requirements and the timing of its provision are considered.	Green economy and sustainable entrepreneurship, Fundamentals of financial literacy, Managerial economics, Time management, , Railway track 1,2,3, Railway construction technology, Technological processes of railway construction	Estimated pricing in architecture and construction, Minor program 3, Final certification
		Organization of construction production				LO 7,8,10,11	The formation of students' professional skills on the basic principles and methods of organizing road works, organizational and technical training and calendar planning of road works, as well as gaining knowledge in the field of production and economic activities of enterprises when choosing rational options for organizational and planning solutions that ensure increased economic efficiency of production. Studies the principles and methods of project management, time control and planning, and resource allocation.	Green economy and sustainable entrepreneurship, Fundamentals of financial literacy, Managerial economics, Time management, , Railway track 1,2,3, Railway construction technology, Technological processes of railway construction	Estimated pricing in architecture and construction, Minor program 3, Final certification
PD	KV	Railway track diagnostics	150	5	9	LO8,10	This discipline studies the methods and technologies for assessing the condition of railway infrastructure, covering aspects of technical diagnostics of tracks, flaw detection, as well as the analysis of the condition of various elements of the railway track to ensure its safety and reliability.	Maintenance and repair of railway track 1, Occupational safety and health, Minor program 1,2	Final certification, Basic and profile disciplines of the master’s degree
		Monitoring of the technical condition of the railway track				LO8,10	The discipline studies methods and tools for assessing the condition of the railway track, identifying defects, and predicting its reliability. It covers visual and instrumental inspection methods, track maintenance standards, and the planning of repair works	Maintenance and repair of railway track 1, Occupational safety and health, Minor program 1,2	Final certification, Basic and profile disciplines of the master’s degree

							to ensure the safe movement of trains.		
Infrastructure programs module / Additional educational program module									
PD	KV	Information modeling technology in architecture and construction	90	3	7	LO4	The purpose of the course "Information Modeling Technology in Architecture and Construction" is to provide students with the basics of theoretical and practical knowledge and skills in the use of information modeling technologies (BIM) used in the design, construction and operation of buildings and transport facilities, as well as to improve the effectiveness of interaction between participants in the construction process.	Engineering mathematics 1,2, Construction physics, Information and communication technologies, Digital inclusion, Engineering graphics and computer modeling, Basics of Python programming, Engineering geodesy, Educational practice (geodetic)	Final certification, Basic and profile disciplines of the master's degree
		Minor program 1				LO1,4	The first of the three disciplines, which allows you to form additional professional competencies in various subject areas.	Construction mechanics, Mechanics of structural strength, Railway track 1,2, Fundamentals of railway design, Railway surveys and design, Reconstruction of railways	Computer-aided design of railways, Automated railway track design systems, Railway track diagnostics, Monitoring of the technical condition of the railway track
PD	KV	Regulatory and technical documentation in railway construction and track facilities	90	3	8	LO 5,7,8,10	This discipline studies the system of standards, norms, and rules governing the design, construction, repair, and maintenance of railway tracks and related structures, with particular attention paid to the study of GOSTs, SNiPs, technical specifications, and instructions that ensure the safety, reliability, and quality of railway infrastructure.	Railway surveys and design, Railway construction technology, Technological processes of railway construction, Production practice 1	Maintenance and repair of railway track 2, Production practice 2/ Pre-graduate practice, Final certification
		Minor program 2				LO 3,8,9	The second of the three disciplines, which allows you to form additional professional competencies in various subject areas.	Professionally oriented foreign language, Railway track 1,2,3, A seamless path, Fundamentals of railway design, Railway surveys and design, Reconstruction of railways, Railway construction technology, Technological processes of railway construction	Maintenance and repair of railway track 2, Railway track diagnostics, Monitoring of the technical condition of the railway track
PD	KV	Estimated pricing in	90	3	9	LO5,6	The purpose of the course is to determine the	Green economy and sustainable	Final certification, Basic and

		architecture and construction					volume, cost, and complexity of the upcoming work, as well as to monitor the completion of work and the consumption of materials. The means of cost estimation are the current estimated regulatory documents of the Republic of Kazakhstan, which contain information on labor costs, the time of use of machines, mechanisms, necessary materials, products and structures, both in quantitative and monetary measures, distributed by type of work	entrepreneurship, Fundamentals of financial literacy, Managerial economics, Time management, Fundamentals of railway design, Railway surveys and design, Organization and planning of railway construction, Organization of construction production	profile disciplines of the master's degree
		Minor program 3				LO8,10	The third of the three disciplines, which allows you to form additional professional competencies in various subject areas.	Organization and planning of railway construction, Organization of construction production, Maintenance and repair of railway track 1	Final certification, Basic and profile disciplines of the master's degree
		Total:	**2190**	**73**					

Head of the department of «Transport construction» **G.B. Karibaeva**