Head of the infrastructure development sector of the branch of «NC «Kazakhstan railways» JSC – «Almaty branch of the backbone network»

M.S. Bekbosunov

Director of the institute of Transport and construction of «M. Tynyshpayev ALT University» JSC

Sh.A. Abdreshov

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CATALOGUE OF UNIVERSITY COMPONENT DISCIPLINES

EDUCATIONAL PROGRAM **6B07179 – Engineering and management of transport highways**

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
BD	VK	Engineering mathematics 1	150	5	1	LO1	The discipline "Engineering Mathematics 1" studies the basic concepts of higher mathematics and its applications. The course sections include elements of linear algebra and analytical geometry, an introduction to mathematical analysis, and differential calculus of functions of one and several variables. The purpose of the course is to master the mathematical apparatus for solving theoretical and applied problems of a specific profile, to gain an understanding of mathematical modeling, and to develop analytical and systems thinking, which makes it possible to effectively solve engineering problems. The discipline uses interactive teaching methods and performing computational and graphical work.	Basic school knowledge in mathematics	Engineering mathematics 2, Electrical engineering and the basics of electronics, Electrotechnical calculations of construction facilities, Information and communication technologies, BIM technologies in the construction of infrastructure facilities, Minor program 1, Digital inclusion, Basics of Python programming, Building materials, Final certification
BD	VK	Engineering	150	5	2	LO1	The formation of students' mathematical	Basic school knowledge in	Electrical engineering and the

		mathematics 2					knowledge and skills necessary for the study of related natural science disciplines, disciplines of the professional cycle and skills of mathematical modeling and research in professional activities. The course sections include integral calculus of functions of one and several variables, ordinary differential equations, and series theory. Special attention is paid to the application of mathematical methods to solve engineering problems.	mathematics, Engineering mathematics 1, Construction physics, Engineering graphics and computer modeling, Technical mechanics	basics of electronics, Electrotechnical calculations of construction facilities, Information and communication technologies, BIM technologies in the construction of infrastructure facilities, Minor program 1, Digital inclusion, Final certification
BD	VK	Construction physics	150	5	1	LO1	Formation of knowledge, skills and competencies necessary for the development, design and operation of energy-efficient, comfortable and durable buildings and structures. Studies the physical processes and phenomena occurring in building structures and buildings, as well as their interaction with the environment, the basics of building and architectural acoustics, building climatology, lighting engineering, thermal engineering.	Basic school knowledge in physics	Engineering mathematics 2, Electrical engineering and the basics of electronics, Electrotechnical calculations of construction facilities, Building materials, Information and communication technologies, BIM technologies in the construction of infrastructure facilities, Minor program 1, Digital inclusion, Final certification
BD	VK	Technical mechanics	180	6	1	LO1	Technical mechanics studies the behavior of deformable solid bodies under the influence of external forces. This discipline encompasses the analysis of static equilibrium, kinematic laws of motion, and dynamic behavior of mechanical systems. The acquired knowledge is a fundamental basis for engineering design, ensuring the calculation of the strength, stiffness, and stability of structures, as well as the analysis of their operational characteristics.	Basic school knowledge in mathematics and physics	Engineering mathematics 2, Electrical engineering and the basics of electronics, Electrotechnical calculations of construction facilities, Bases and foundations, Building constructions, Artificial structures on transport routes, Engineering transport structures, Final certification
BD	VK	Engineering geodesy	180	6	3	LO2,5	Forms professional competencies that determine the readiness and ability of the bachelor to use basic knowledge in the	Engineering graphics and computer modeling, Basics of Python programming	Fundamentals of transportation corridor design, Design and calculation of

							field of geodesy, allows you to make geodetic measurements related to the solution of typical construction tasks, a detailed layout of structures, to control the geometric shapes of the erected structure, perform executive surveying results of individual stages of construction and installation work, gives skills for the application of basic geodetic instruments for specific production conditions.		railway lines, Design and calculation of highways, Reconstruction of transport routes, Modernization of transport highways, Computer-aided design of transportation corridors, Automated highway design systems, BIM technologies in the construction of infrastructure facilities, Minor program 1, Final certification
BD	VK	Building materials	180	6	2	LO5	Apply modern building materials, demonstrate the main indicators of quality, modern methods of production of building materials for the transport industry, the main laws and dependence on the physical and mechanical properties, production technology and conditions of formation, methods of finishing, mastering technological processes of construction production, production of building materials, products and structures on the artificial structures under construction.	Engineering mathematics 1, Construction physics	Building constructions, Geology and soil mechanics, Geoinformation systems in geology, Bases and foundations, Geotechnics in foundation engineering, Artificial structures on transport routes, Engineering transport structures, Final certification
BD	VK	Building constructions	120	4	4	LO5	The discipline studies the design, analysis and application of various types of structures such as buildings, bridges and transport structures. It covers materials, mechanical properties and strength calculation methods. Knowledge in this area is necessary to create safe and sustainable facilities that meet modern standards and requirements.	Technical mechanics, Building materials, Technical mechanics	Bases and foundations, Geotechnics in foundation engineering, Artificial structures on transport routes, Engineering transport structures, Final certification
BD	VK	Occupational health and safety	150	5	8	LO8	Formation of knowledge and skills necessary to ensure safe working and living conditions. The legal and organizational foundations of occupational	Environmentally sustainable technologies, Green economy and sustainable entrepreneurship, Electrical	Maintenance and repair of highways, Monitoring the condition of transport highways, Engineering

							safety, methods of occupational risk assessment and management, means of individual and collective protection, emergency prevention, as well as measures to prevent injuries and occupational diseases are studied. Special attention is paid to the creation of a safe working environment, compliance with labor protection standards and requirements, as well as the formation of a safety culture in professional activities.	engineering and the basics of electronics, Electrotechnical calculations of construction facilities, Highway construction technology, Technological processes of highway construction, Production practice 1	structures monitoring systems, Production practice 2/ Pre-graduate practice, Final certification
BD	VK	Engineering graphics and computer modeling	120	4	1	LO2	The course covers the principles of technical drawing and engineering graphics, as well as modern 3D modeling methods using specialized software, aimed at developing skills in designing and visualizing technical objects, creating digital models and diagrams, drafting, modeling structures, and analyzing their parameters for solving engineering problems.	Basic school knowledge in mathematics, drawing and computer science	Engineering mathematics 2, Engineering geodesy, Educational practice (geodetic), Information and communication technologies, Digital inclusion, IT in transport engineering, Fundamentals of transportation corridor design, Design and calculation of railway lines, Design and calculation of highways, Final certification
BD	VK	Basics of Python programming	90	3	2	LO1,2	The discipline studies the syntax and semantics of the Python language, algorithmization and program design, program structuring and solving problems related to artificial intelligence, learns machine learning, data processing and intelligent system development methods, and analyzes the use of AI in various fields, forming professional competencies in programming and the basics of artificial intelligence.	Engineering mathematics 1	Engineering geodesy, Educational practice (geodetic), Information and communication technologies, Digital inclusion, Computer-aided design of transportation corridors, Automated highway design systems, IT in transport engineering, BIM technologies in the construction of infrastructure facilities, Minor program 1, Final certification

BD	VK	Professionally oriented foreign language	90	3	6	LO2	Formation and development of professional communicative competence in a foreign language necessary for professional activity, proficiency in a professional foreign language for written and oral information exchange, development of skills in reading and understanding professional literature on their specialty in a foreign language, development of the ability to express their thoughts orally and in writing in situations of professional and business communication.	The history of Kazakhstan, Kazakh (russian, foreign) language, Physical culture, Sociology, Cultural studies, Psychology, Basics of law and anti-corruption culture, Environmentally sustainable technologies, Green economy and sustainable entrepreneurship, Fundamentals of financial literacy	Transport logistics, Interaction of modes of transport, Regulatory and technical documentation in transport construction, Minor program 2, Final certification
BD	VK	Educational practice (geodetic)	60	2	3	LO2,5	Educational practice (geodesy) is a key stage of education for students of architectural, construction and related specialties. It is aimed at consolidating theoretical knowledge in the discipline of Engineering Geodesy and acquiring practical skills in working with geodetic instruments and processing the data obtained.	Engineering graphics and computer modeling, Basics of Python programming	Fundamentals of transportation corridor design, Design and calculation of railway lines, Design and calculation of highways, Reconstruction of transport routes, Modernization of transport highways, Computer-aided design of transportation corridors, Automated highway design systems, BIM technologies in the construction of infrastructure facilities, Minor program 1, Final certification
PD	VK	Fundamentals of transportation corridor design	150	5	4	LO1,3,4	The course studies the basic principles and methods of designing highways and transport structures, covering key aspects of creating safe, efficient and sustainable transport systems, laying the foundation for in-depth study of specialized areas of transport engineering, and prepares specialists for the development of modern, functional and efficient transport infrastructure.	Information and communication technologies, Engineering graphics and computer modeling, Introduction to transport infrastructure, General course of transport routes, Engineering geodesy, Educational practice (geodetic)	Design and calculation of railway lines, Design and calculation of highways, Reconstruction of transport routes, Modernization of transport highways, Computer-aided design of transportation corridors, Automated highway design systems, Artificial structures

									on transport routes, Engineering transport structures, Managerial economics, Time-management, The basics of cost accounting, Transport logistics, Interaction of modes of transport, BIM technologies in the construction of infrastructure facilities, Minor program 1, Regulatory and technical documentation in transport construction, Minor program 2, Final certification
PD	VK	Engineering networks and communications	150	5	7	LO9	The discipline studies the design, construction, operation and maintenance of life support systems of buildings, structures and territories that provide comfortable and safe conditions for people and the functioning of various objects, and is fundamental for specialists in the field of construction, architecture, housing and communal services and related industries, providing the necessary knowledge for the creation of a modern and sustainable infrastructure.	Introduction to transport infrastructure, General course of transport routes, Electrical engineering and the basics of electronics, Electrotechnical calculations of construction facilities	Final certification, Basic and profile disciplines of the master’s degree
PD	VK	Introduction to project and process management	90	3	3	LO1,3,4	The course provides with a basic knowledge and understanding of the principles and methods of effective project management and business process optimization, covering key knowledge areas including integration, scope, timing, cost, quality, resource, communications, risk, procurement and stakeholder management, as well as introducing key project management terminology such as project, program, project portfolio, life	Engineering graphics and computer modeling, Introduction to transport infrastructure, General course of transport routes, Engineering geodesy, Educational practice (geodetic), Fundamentals of transportation corridor design	Reconstruction of transport routes, Modernization of transport highways, Computer-aided design of transportation corridors, Automated highway design systems, Managerial economics, Time-management, The basics of cost accounting, Transport logistics, Interaction of modes

							cycle and stakeholders.		of transport, Regulatory and technical documentation in transport construction, Production practice 1, Production practice 2/ Pre-graduate practice, Final certification
PD	VK	Design and calculation of railway lines	180	6	5	LO1,3,4	The course provides fundamental knowledge and skills to address complex issues in the design, construction and operation of railway, covering the principles of creating safe, durable and cost-effective highways, incorporating safety requirements into the design stage and the correct placement of road features such as signs and barriers.	Engineering graphics and computer modeling, Introduction to transport infrastructure, General course of transport routes, Engineering geodesy, Educational practice (geodetic), Fundamentals of transportation corridor design	Reconstruction of transport routes, Modernization of transport highways, Computer-aided design of transportation corridors, Automated highway design systems, Highway construction technology, Technological processes of highway construction, Managerial economics, Time-management, The basics of cost accounting, Transport logistics, Interaction of modes of transport, Regulatory and technical documentation in transport construction, BIM technologies in the construction of infrastructure facilities, Minor program 1, Regulatory and technical documentation in transport construction, Minor program 2, Production practice 1, Production practice 2/ Pre-graduate practice, Final certification
PD	VK	Design and calculation of highways	150	5	6	LO1,3,4	The course studies the design, construction, and operation of highways and urban streets, including detailed design of road elements, calculation of earthworks	Engineering graphics and computer modeling, Introduction to transport infrastructure, General course	Reconstruction of transport routes, Modernization of transport highways, Computer-aided design of

							volumes, strength and stability of structures, drainage systems, use of modern technologies and software, organization of construction works, environmental impact assessment, and issues related to road operation and maintenance, providing a comprehensive understanding of the processes involved in the creation and maintenance of transport highways.	of transport routes, Engineering geodesy, Educational practice (geodetic), Fundamentals of transportation corridor design	transportation corridors, Automated highway design systems, Highway construction technology, Technological processes of highway construction, Managerial economics, Time-management, The basics of cost accounting, Regulatory and technical documentation in transport construction, BIM technologies in the construction of infrastructure facilities, Minor program 1, Regulatory and technical documentation in transport construction, Minor program 2, Production practice 1, Production practice 2/ Pre-graduate practice, Final certification
PD	VK	IT in transport engineering	150	5	8	LO2,9	The course studies the use of information technologies to solve problems of planning, design, construction, operation and management of transport systems, covering a wide range of topics related to the use of IT at all stages of the life cycle of transport facilities and processes.	Electrical engineering and the basics of electronics, Electrotechnical calculations of construction facilities, Information and communication technologies, Engineering graphics and computer modeling, Basics of Python programming, Monitoring the condition of transport highways, Engineering structures monitoring systems, Transport logistics, Interaction of modes of transport	Final certification, Basic and profile disciplines of the master’s degree
PD	VK	Maintenance and repair of railway lines	150	5	8	LO5,8	The course studies methods for maintaining the operational suitability of railways,	Electrical engineering and the basics of electronics,	The basics of cost accounting, Minor program 3, Production

							including damage diagnostics, reinforcement of the railway superstructure, restoration of engineering structures, and organization of repair works considering traffic intensity and climatic conditions, aimed at training specialists for effective maintenance and repair of railways and transport routes, ensuring their safety and cost-efficiency.	Electrotechnical calculations of construction facilities, Artificial structures on transport routes, Engineering transport structures, Highway construction technology, Technological processes of highway construction, Monitoring the condition of transport highways, Engineering structures monitoring systems, Production practice 1	practice 2 / Pre-graduate practice, Final certification
PD	VK	Maintenance and repair of highways	150	5	9	LO5,8	The discipline studies methods of maintaining the operational suitability of roads, including diagnostics of damage, strengthening of road surfaces, restoration of artificial structures and organization of repair work taking into account the intensity of traffic and climatic conditions, training specialists for the effective maintenance and repair of highways while ensuring safety and cost-effectiveness.	Electrical engineering and the basics of electronics, Electrotechnical calculations of construction facilities, Artificial structures on transport routes, Engineering transport structures, Highway construction technology, Technological processes of highway construction, Monitoring the condition of transport highways, Engineering structures monitoring systems, Occupational safety and health, Regulatory and technical documentation in transport construction, Minor program 2, Production practice 1	Final certification, Basic and profile disciplines of the master’s degree
PD	VK	Production practice 1	150	5	6	LO5,8	The main objectives of industrial practice 1 are: consolidation of theoretical knowledge and practical skills in the chosen educational program in an industrial environment, acquisition of organizational work experience, obtaining a working specialty, formation of practical skills and	Design and calculation of railway lines, Design and calculation of highways	Reconstruction of transport routes, Modernization of transport highways, Monitoring the condition of transport highways, Engineering structures monitoring systems, Maintenance and repair of

							competencies in the process of mastering the bachelor's program. It is conducted in the practice bases at enterprises according to this educational program.		railway lines, Maintenance and repair of highways, Occupational safety and health, Regulatory and technical documentation in transport construction, Production practice 2 / Pre-graduate practice, Final certification
PD	VK	Production practice 2 / Pre-graduate practice	150	5	9	LO5,8	The purpose of the 2 / Pre-graduate internship for bachelors is to ensure the relationship between the theoretical knowledge gained during the assimilation of the chosen educational program and practical activities. The objectives of this practice are to consolidate and deepen the theoretical knowledge acquired by students in during the learning process, collecting information for writing a final qualifying thesis, studying best practices at the enterprise, as well as gaining experience in independent research, mastering various methods of scientific work. It is conducted in the practice bases at enterprises according to this educational program.	Design and calculation of railway lines, Design and calculation of highways, Reconstruction of transport routes, Modernization of transport highways, Monitoring the condition of transport highways, Engineering structures monitoring systems, Maintenance and repair of railway lines, Occupational safety and health, Regulatory and technical documentation in transport construction, Production practice 1	Final certification, Basic and profile disciplines of the master’s degree
PD	VK	FINAL CERTIFICATION	240	8	9	LO1-LO9	The objectives of the thesis are to identify the degree of assimilation by the bachelor of the content of the educational program, to check his readiness for independent activity in the direction of the educational program, to consolidate and deepen practical work skills. A comprehensive exam is also provided.		
		Total:	**3330**	**111**					

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