AGREED
"GEO TRACK" LLP Director,
Candidate of Technical Sciences
Nusupov D.K.
«20» 03 2025г.

I APPROVE
Directors of the Institute "TI"
Abdreshov Sh.A.
«19» 03 2025 г.

CATALOGUE OF DISCIPLINES OF THE UNIVERSITY COMPONENT

EDUCATIONAL PROGRAM 6B07349 Construction of bridges and interchanges

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

Cycle	Component	Name of the discipline	Total labor intensity		Semester	Learning outcomes	Brief description of the discipline	Prerequisites	Postrequisites
			academic hours	academic credits					
1	2	3	4	5	6	7	8	9	10
BD	VK	Engineering Mathematics 1	150	5	1	PO2 PO4	The course "Engineering Mathematics 1" explores the fundamental concepts of higher mathematics and its applications. Sections of the course include elements of linear algebra and analytic geometry, an introduction to mathematical analysis, and differential calculus for functions of one and several variables. The course aims to master the mathematical apparatus for solving theoretical and applied problems in a specific field, gain an understanding of mathematical modeling, and develop analytical and systems thinking to effectively solve engineering problems. This course utilizes interactive teaching methods and computational and graphical work.	Basic school knowledge	Engineering Mathematics 2, Strength of Materials, Structural Mechanics, Geology and Soil Mechanics
BD	VK	Engineering Mathematics 2	150	5	2	PO2 PO4	To develop students' mathematical knowledge and skills necessary for studying related natural sciences, professional disciplines, and mathematical modeling and research skills in their professional activities. Course sections include integral calculus of functions of one and several variables, ordinary	Engineering Mathematics 1, Constructio	Theoretical mechanics, Building structures, Strength of

							differential equations, and series theory. Particular attention is paid to the application of mathematical methods to solving engineering problems.	n Physics	materials, Structural mechanics, Strength mechanics of structures.
BD	VK	Building physics	150	5	1	PO2 PO4	Developing the knowledge, skills, and competencies necessary for the development, design, and operation of energy-efficient, comfortable, and durable buildings and structures. This program explores the physical processes and phenomena occurring in structures and buildings, as well as their interaction with the environment, the fundamentals of construction and architectural acoustics, building climatology, lighting engineering, and thermal engineering.	Engineering Mathematics 1	Building Materials, Strength of Materials, Structural Mechanics, Bridges and Pipes, Design of Bridge and Tunnel Crossings
BD	VK	Construction chemicals	120	4	2	PO2 PO4	The development of knowledge in construction chemistry is linked to the advancement of science and technology aimed at improving building materials and their application processes. Construction chemistry studies and develops chemical materials, additives, and substances that influence the properties of building structures, ensuring their strength, durability, resistance to external influences, and energy efficiency. An important part of the course is the study of the environmental impact of construction chemicals.	Engineering Mathematics 1, Construction Physics	Building structures, Geology and soil mechanics, Foundations and foundations, Hydraulics, hydrology, hydrometry
BD	VK	Engineering geodesy	180	6	3	PO1 PO5	Develops professional competencies that determine the bachelor's readiness and ability to use basic knowledge in the field of geodesy, allows for geodetic measurements related to solving typical construction problems, detailed breakdown of structures, control of the geometric shapes of the structure being erected, perform executive surveys of the results of individual stages of construction and installation work, and provides skills in the use of basic geodetic instruments for specific production conditions.	Engineering Mathematics 1, Engineering Mathematics 2, Construction Physics, Construction Materials	Construction Materials, Geology and Soil Mechanics, Foundations and Foundations, Bridge and Pipe Design, Tunnels and Subways
BD	VK	Building materials	180	6	2	PO4	To apply modern building materials, demonstrate the main quality indicators, modern methods of production of building	Engineering	Building structures,

							materials for the transport industry, the main patterns and dependencies on physical and mechanical properties, production technology and formation conditions, finishing methods, mastering the technological processes of construction production, the manufacture of building materials, products and structures on erected artificial structures.	Mathematics 1, Engineering Mathematics 2, Construction Physics	Strength of materials, Structural mechanics, Geology and soil mechanics, Transport interchanges
BD	VK	Building structures	120	4	4	PO2 PO4	This discipline studies the design, analysis, and application of various types of structures, such as buildings, bridges, and transportation facilities. It covers materials, mechanical properties, and strength calculation methods. Knowledge in this area is essential for creating safe and sustainable structures that meet modern standards and requirements.	Engineering Mathematics 1, Engineering Mathematics 2, Construction Physics, Construction Chemistry, Construction Materials	Foundations and bases, Design of bridges and tunnel crossings, Design of bridges and pipelines, Reconstruction of bridges and interchanges
BD	VK	Occupational health and safety	150	5	8	PO7	Developing the knowledge and skills necessary to ensure safe working and living conditions. The course covers the legal and organizational foundations of occupational safety, methods for assessing and managing professional risks, personal and collective protective equipment, emergency prevention, and measures to prevent injuries and occupational diseases. Particular attention is paid to creating a safe work environment, compliance with occupational safety standards and requirements, and fostering a safety culture in professional activities.	Psychology, Sustainable Ecology, Engineering Mathematics 1, Engineering Mathematics 2, Construction Physics, Construction Chemistry, Constructio	Maintenance and repair of tunnels and subway stations, Survey and testing of bridges and interchanges, Cost estimation in architecture and construction

								n Materials	
BD	VK	Engineering graphics and computer modeling	120	4	1	PO1	The course explores the principles of technical drawing and engineering graphics, as well as modern 3D modeling techniques using specialized software, aimed at developing skills in designing and visualizing technical objects, creating digital models and diagrams, constructing drawings, modeling structures, and analyzing their parameters to solve engineering problems.	Engineering Mathematics 1, Engineering Mathematics 2	Building Structures, Python Programming Basics, Strength of Materials, Structural Mechanics, Computer-Aided Design of Bridges and Interchanges
BD	VK	Python Programming Basics	90	3	2	PO7	This course explores the syntax and semantics of the Python language, algorithmization and program design, program structuring, and solving problems related to artificial intelligence. Students master methods of machine learning, data processing, and the development of intelligent systems. Students also analyze the application of AI in various fields, developing professional competencies in programming and the fundamentals of artificial intelligence.	Engineering Mathematics 1, Engineering Mathematics 2, Engineering Graphics and Computer Modeling	Building structures, Structural mechanics, Automated design of bridges and interchanges, Design of bridge crossings and tunnel intersections, Design of interchanges
BD	VK	Professionally oriented foreign language	90	3	6	PO1	Formation and development of foreign language professional communication competence 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 in one's specialty in a foreign language, development of the ability to express one's thoughts orally and in writing in situations of professional and business communication.	Foreign language, Kazakh (Russian) language, Culturology, Psychology	Occupational health and safety, Design of transport interchanges, Maintenance and repair of bridges, pipes and transport interchanges, Maintenance and repair of tunnels and

									subway stations
BD	VK	Educational practice (geodetic)	60	2	3	PO3.5.7	Educational practice (geodetic) The organization of educational practice is aimed at familiarizing bachelors with the areas of professional activity and training profiles, with the ability to geodetic survey of the area, forward and reverse traverse, leveling survey, referencing to benchmarks, setting out points and elevation marks from a map, solving typical engineering and geodetic problems.	Engineering Mathematics 1, Engineering Mathematics 2, Construction Physics, Construction Chemistry, Construction Materials	Building structures, Strength of materials, Structural mechanics, Bridge and pipe design
BD	VK	Fundamentals of Artificial Intelligence	90	3	5	PO2	This course introduces students to the fundamental concepts, methods, and applications of artificial intelligence. The course aims to provide students with a basic understanding of the capabilities and applications of artificial intelligence in the modern world and their implications for various fields of activity.	Engineering Mathematics 1, Engineering Mathematics 2, Construction Physics, Construction Chemistry, Construction Materials Building structures, Strength of materials, Structural mechanics, Geology and soil mechanics.	Design of bridges and pipelines, Design of transport interchanges, Reconstruction of bridges and transport interchanges, Maintenance and repair of bridges, pipelines and transport interchanges, Reliability and load-bearing capacity of bridges and transport interchanges

BD	VK	Educational practice (geodetic)	60	2	4	PO3.5.7	Educational practice (geodetic) The organization of educational practice is aimed at familiarizing bachelors with the areas of professional activity and training profiles, with the ability to geodetic survey of the area, forward and reverse traverse, leveling survey, referencing to benchmarks, setting out points and elevation marks from a map, solving typical engineering and geodetic problems.	Engineering Mathematics 1, Engineering Mathematics 2, Structural Mechanics, Design of Bridges and Tunnel Crossings	Design of transport interchanges, Automated design of bridges and transport interchanges, Reliability and load-bearing capacity of bridges and transport interchanges
PD	VK	Design of bridges and tunnel crossings	150	5	5	PO5 PO6	The study of this discipline forms theoretical and practical knowledge on the application of methods and techniques for selecting a bridge crossing location for developing a plan and longitudinal profile of railways and highways when crossing water obstacles, taking into account the climatic, topographic, engineering-geological, hydrological and environmental conditions of the construction area, in order to minimize the costs of material and technical resources.	Design of bridges and tunnel crossings, Design of bridges and pipes	Maintenance and repair of bridges, pipes and interchanges, Automated design of bridges and interchanges, Inspection and testing of bridges and interchanges
PD	VK	Design of bridges and pipes	150	5	6	PO7	This course examines the theoretical and practical aspects of the design, calculation, and construction of bridge structures and culverts. It covers a wide range of issues related to ensuring the safety, durability, and cost-effectiveness of these engineering structures. The goal of the course is to train qualified engineers capable of independently solving problems in the design, construction, and operation of bridge structures and culverts, taking into account modern requirements for safety, reliability, and cost-effectiveness.	Engineering graphics and computer modeling, Structural mechanics, Geology and soil mechanics,	Transport interchanges, tunnels and subways, reconstruction of bridges and transport interchanges, maintenance and repair of bridges, pipes and transport interchanges, organization and planning

									of construction of bridges, pipes and transport interchanges, inspection and testing of bridges and transport interchanges
PD	VK	Design of transport interchanges	150	5	7	PO5 PO8	This course examines the design, construction, and operation of complex transport hubs, including interchange types, geometric elements, traffic management, capacity calculations, safety, economic assessment, current trends, and environmental impacts, all aimed at ensuring efficient and safe traffic flows.	Geology and Soil Mechanics, Foundations and Foundations, Bridges and Pipelines	Design of bridges and pipelines, Design of transport interchanges, Reliability and load-bearing capacity of bridges and transport interchanges, Survey and testing of bridges and transport interchanges
PD	VK	Bridges and pipes	150	5	4	PO5 PO6	This course studies the design, construction, operation and maintenance of bridges and pipelines, covering design types, materials, loads, calculations and regulatory requirements, combining knowledge from structural mechanics, hydraulics, materials science and engineering technology.	Geology and Soil Mechanics, Bridges and Pipelines, Transport Interchanges	Reconstruction of bridges and interchanges, Maintenance and repair of bridges, pipes and interchanges, Reliability and load-bearing capacity of bridges and interchanges,

									Organization and planning of construction of bridges, pipes and interchanges
PD	VK	Transport interchanges	150	5	5	PO8	This course examines the complex engineering, organizational, and economic aspects of the design, construction, and operation of multi-level transport hubs, including geometry, capacity, traffic safety, environmental impact, and current trends in ensuring efficient and sustainable traffic flow.	Bridge and Pipe Design, Bridge and Tunnel Crossing Design, Bridges and Pipes, Interchanges, Tunnels and Subways	Maintenance and repair of bridges, pipes and interchanges, Maintenance and repair of tunnels and subway stations, Machines and equipment in bridge construction, Organization and planning of construction of bridges, pipes and interchanges, Inspection and testing of bridges and interchanges
PD	VK	Tunnels and subways	150	5	6	PO6 PO8	The course is a comprehensive study of the theories and practices of planning, construction, operation and reconstruction of underground structures, various types of tunnels and subway systems, covering, among other things, the basic principles and methods of design, construction technologies, operating rules, regulatory frameworks and being important foundations for the training of specialists in the field of transport construction, mining and relevant standards for successful professional activity in the field of urban and transport activities.	Bridge and tunnel design, Bridge and tunnel crossing design, Bridges and tunnels,	Maintenance and repair of tunnels and subway stations, Survey and testing of bridges and interchanges, Cost

								Interchanges, Tunnels and subways, Bridge and interchange reconstruction	estimation in architecture and construction
PD	VK	Reconstruction of bridges and interchanges	150	5	7	PO1 PO8	This discipline explores comprehensive methods and approaches to the restoration, modernization, and improvement of existing bridge and transport structures, including analysis of their current condition, damage diagnostics, reinforcement design, the application of modern construction and engineering technologies, and the optimization of traffic flows to improve the safety, durability, and functionality of infrastructure, taking into account environmental and economic aspects.	Bridge and tunnel design, bridge and tunnel crossing design, bridges and tunnels, interchanges, tunnels and subways, bridge and interchange reconstruction, bridge, tunnel and interchange maintenance and repair	Industrial Internship 2/ Pre-Graduation Internship, Survey and Testing of Bridges and Interchanges, Cost Estimation in Architecture and Construction
PD	VK	Maintenance and repair of bridges, pipelines and interchanges	180	6	8	PO8	This course examines the principles, methods, and technologies used to maintain the operational condition and restore the performance characteristics of artificial transport structures, including bridges, culverts, and multi-level road intersections, covering issues of preventive maintenance, defect diagnosis, selection of repair methods, and the use of modern materials and technologies.	Basic school knowledge	Engineering Mathematics 2, Strength of Materials, Structural Mechanics, Geology and Soil Mechanics
PD	VK	Maintenance and repair of tunnels and metro stations	150	5	9	PO8	This course provides a comprehensive study of the principles, methods, and technologies for maintaining and restoring the operational qualities of underground metro structures, including main and station tunnels, stations,	Engineering Mathematics 1,	Theoretical mechanics, Building structures,

							escalator tunnels, and inclined tunnels. It covers the organization of planned preventive measures, diagnostics, the selection of repair methods, and the use of modern materials and equipment in underground environments.	Construction Physics	Strength of materials, Structural mechanics, Strength mechanics of structures.
PD	VK	Industrial practice 1	150	5	6	PO3,5,7,8	The main objectives of industrial internships are to reinforce theoretical knowledge and practical skills in the chosen educational program in a production setting, gain organizational experience, acquire a trade specialty, and develop practical skills and competencies while completing the bachelor's degree program. These internships are conducted at the internship centers of companies within the educational program.	Engineering Mathematics 1	Building Materials, Strength of Materials, Structural Mechanics, Bridges and Pipes, Design of Bridge and Tunnel Crossings
PD	VK	Industrial practice 2	150	5	9	PO3,5,7,8	The purpose of the internship for bachelor's students is to ensure a connection between the theoretical knowledge acquired in the chosen educational program and practical work. The objectives of this internship are to consolidate and deepen the theoretical knowledge acquired by students during their studies, gather information for their final thesis, study best practices at the enterprise, and gain experience in independent research and mastery of various research methods. It is conducted at the internship bases at the enterprises according to this educational program.	Engineering Mathematics 1, Construction Physics	Building structures, Geology and soil mechanics, Foundations and foundations, Hydraulics, hydrology, hydrometry
MSW		FINAL CERTIFICATION	241	8		PO1-8	The objectives of the thesis are to assess the bachelor's degree program content, evaluate their readiness for independent work within the program, and consolidate and deepen their practical skills. A comprehensive exam is also included.	Engineering Mathematics 1, Engineering Mathematics 2, Construction Physics, Construction Materials	Construction Materials, Geology and Soil Mechanics, Foundations and Foundations, Bridge and Pipe Design, Tunnels and Subways

Head of the department "transport engineering"_____ Bykhozhaeva G. S.