AGREED
Deputy Head of production of the Almaty operational locomotive depot of the branch of LLP "KTZ-Freight transportation" - "Almaty branch of FT"
_____ Iskakov M.C.
«30» 03 2023 y.

APPROVED
Director of the Institute "Transport Engineering"
_____ Chigambayev T.O.
«30» 03 2023 y.

«Логистика және көлік академиясы» АҚ
АО «Академия логистики и транспорта»
Институт «Транспортная инженерия»

CATALOG OF ELECTIVE COMPONENT DISCIPLINES

EDUCATIONAL PROGRAM 6B07117 - LOCOMOTIVES

Level of education: bachelor course **Time of study: 4 years** **Year of admission: 2023 y.**

Module	Cycle	Component	Name of discipline	Total labor input		Semester	Learning outcomes	Brief description of the discipline	Prerequisites	Post requisites	Department
				in academic hours	in academic credits						
1	2	3	4	5	6	7	8	9	10	11	12
Module 1 – General education disciplines	GED	EC1	Ecology and life safety	150	5	3	ON5	The study of the basic environmental concepts, environmental problems and approaches to their solution, sources and types of environmental pollution by enterprises, the principles of standardizing the quality of atmospheric air and water, the main provisions of legislation in various fields, natural and man-made emergencies, their causes, methods of prevention and protection . Teaching methods - analysis of specific situations (case-study).	Applied Physics, Engineering Mathematics	Labor protection, Methods of non-destructive control of rolling stock, IT technologies in transport, Ensuring traffic safety in transport, Organization of operational work of the railway section, Environmental management in transport, Resource conservation in transport	MV&LS

1	2	3	4	5	6	7	8	9	10	11	12
		EC2	Scientific research methods				ON2, ON3	Obtaining theoretical and applied knowledge by students on the methods of scientific research of problems in the field of study, training of specialists with the skills of cognitive activity in the field of science, the formation of deep ideas about the content of scientific activity, its methods and forms of knowledge.	Applied Physics, Engineering Mathematics, Fundamentals of Computer Modeling	Methods of non-destructive testing of rolling stock, Theory of automatic control, Dynamics of locomotives, IT technologies in transport, Fundamentals of Rolling stock Reliability, Resource Conservation in Transport, Fundamentals of Rolling stock Design, Final certification, MASTER'S DEGREE DISCIPLINES	SHD&PE
		EC3	Basics of economics and entrepreneurship				ON6	He studies the activities of enterprises in various types of markets, the model of equilibrium and functioning of the market, state regulation of prices and tariffs. Considers the concept of entrepreneurship and the limits of its legal regulation, the conditions for the development of entrepreneurship, organizational and legal forms of doing business, business planning, entrepreneurial secrecy, social responsibility of. Active learning methods: case methods; business role-playing games, group work.	History of Kazakhstan, Engineering Mathematics, Sociology, Cultural Studies, Political Science, Psychology	Organization of operational work of the railway section, Environmental management in transport, Managerial economics	TLM
		EC4	Basics of law and anti-corruption culture				ON1	Improving the public and individual legal awareness and legal culture of students, as well as the formation of a system of knowledge and civil position to combat corruption as an anti-social phenomenon. As a result of studying the course, the student must master 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 the legitimate interests of a person in case of their violation.	History of Kazakhstan, Sociology, Cultural Studies, Political Science, Psychology	Managerial economics, Final certification	SHD&PE

1	2	3	4	5	6	7	8	9	10	11	12
Module 7 – General Engineering competencies	BD	EC1	Fundamentals of calculating the strength of machines and mechanisms	180	6	4	ON7	Studies the basics of the theory of mechanisms and machines, the resistance of materials, calculation and design of general-purpose parts and assemblies widely used in machines to solve problems aimed at improving the reliability, strength and durability of parts and assemblies in design, construction and operation, using modern educational and information technologies. Methods of active learning – performing individual computational and graphical tasks.	Applied Physics, Engineering Mathematics, Structural materials in transport engineering, Theoretical mechanics	Machine parts and design basics, Locomotive Dynamics, Fundamentals of Rolling Stock Reliability	SE
		EC2	Applied Mechanics				ON7	Studies the theoretical foundations and methods of calculations for strength, rigidity, durability and stability of structural elements of transport structures, the main types of mechanisms, parts and assemblies of machines, general principles of design and construction, which is necessary when assessing the reliability of existing equipment in operating conditions. Methods of active learning – performing individual computational and graphical tasks.	Applied Physics, Engineering Mathematics, Structural materials in transport engineering, Theoretical mechanics	Machine parts and design basics, Locomotive dynamics	SE
Module 2 – Natural science competencies	BD	EC1	Heat engineering	180	6	4	ON2	Studies the basics of obtaining, converting, transferring and using heat, thermodynamic cycles of heat engines and calculation of their parameters, types of heat exchange, heat exchangers and methods of their calculation, the principle of operation and design features of heat-power, heat-using machines, aggregates and devices. The discipline contributes to the analysis of energy-saving technology in transport and the determination of trends in the development of heat-engineering machines, equipment, installations and devices.	Applied Physics, Engineering Mathematics	Power plants of transport equipment, Management of locomotive operation processes, Traction theory and principles of energy saving	RS
		EC2	Fluid and gas mechanics, hydroand pneumatic drive				ON2	General laws and equations of hydrodynamics, fluid motion modes and fundamentals of hydrodynamic similarity, laminar and turbulent fluid motion, hydraulic barriers, fluid flow through nozzles and nozzles, hydraulic calculation of pipelines, volumetric hydraulic machines, hydraulic drives and Hydraulic automation, pneumatic drive, pneumatic motor, pumps, hydraulic motors, fans, hydrodynamic transmission, hydraulic drive drives are metal-cutting tools. Teaching methods: problem solving, conducting thematic surveys, open and closed tests.	Applied Physics, Engineering Mathematics, Theoretical Mechanics	Dynamics of locomotives, Power plants of transport equipment, Auto-braking of locomotives and traffic safety	MV&LS

1	2	3	4	5	6	7	8	9	10	11	12
Module 10 - Reliability, diagnostics and repair of locomotives	BD	EC1	Methods of nondestructive control of the rolling stock	270	9	5	ON9, ON11	Study, analysis and classification of the causes of operational and technological defects of components and parts of rolling stock. Advanced methods of non-destructive testing and fault detection of rolling stock are considered. Mastering and practicing practical skills: working with modern diagnostic devices and flaw detectors; understanding and analyzing the results. Training methods used: work with diagnostic equipment, group work, discussion.	Applied Physics, Engineering Mathematics, Structural materials in transport engineering, Research methods, Rolling stock and railway infrastructure	Fundamentals of rolling stock reliability, Locomotive Repair Technology	RS
		EC2	Theory of automatic control				ON2, ON11	Formation of knowledge, skills and abilities of building automatic control systems based on modeling methodology using modern technologies and basic natural science laws. It consists of the following modules: fundamentals of automation of technological processes, the main tasks of the theory of automatic control, mathematical models of automatic control systems, research methods of linear non-linear automatic control systems, random impacts in linear automatic control systems, optimal control problems, current trends in the development of automatic control systems. Interactive teaching methods are used.	Electrical engineering and the basics of electronics	Microprocessor-based locomotive automatic control Systems, Locomotive repair technology, Automation of technological processes	RS
Module 9 – Construction of locomotives	BD	EC1	Dynamics of locomotives	180	6	6	ON4, ON10, ON12	Formation of skills for calculating the dynamic characteristics of locomotives, determining the optimal parameters of the running gear of locomotives. Dynamic system – "locomotive-path"; types of disturbances that cause locomotives to oscillate; methods for calculating the equations of crew oscillations; compilation of equations of vertical oscillations of simplified dynamic models; oscillations with random disturbances; lateral oscillations of locomotives; indicators of dynamic qualities of the mechanical part of locomotives; criteria for safe movement; computer simulation of locomotive dynamics, dynamic strength tests of locomotives. They are used by the "Universal Mechanism" software, Mathcad.	Applied Physics, Engineering Mathematics, Theoretical Mechanics, Fundamentals of Strength Calculation of Machines and Mechanisms, Applied Mechanics, Fluid and Gas Mechanics, Hydraulic and pneumatic drive, Rolling stock and Railway infrastructure	Fundamentals of rolling stock reliability, Final certification	RS

1	2	3	4	5	6	7	8	9	10	11	12
Module 4 -IT competencies		EC2	IT technologies in transport				ON4, ON12	Studies the principles of information flow formation, information flow management in transport systems of various levels of complexity, general principles of building intelligent transport systems (ITS), routing of transport and monitoring of its operation when using ITS, information system design, organization of information exchange between management objects, methods of automated identification of transport objects, methods of location determination, application of information technology in the construction of vehicles. Methods of active learning: computer modeling, project method, work in small groups. It is used by: Mindmap, Python, MSPowerBI, Wialon system.	Information and Communication Technologies, Applied Physics, Engineering Mathematics, Electrical Engineering and fundamentals of electronics, Fundamentals of computer modeling, Methods of scientific research	Locomotive operation Process Management, PowerBI Business Analytics, Final Certification	ICT
Module 11 - Operation of locomotives	BD	EC1	Ensuring traffic safety on transport	180	6	6	ON5, ON12	Acquisition by students of knowledge, principles, conditions and methods of ensuring the safety of vehicles in accident-free operation, instilling skills of an integrated approach to solving transport security problems, including in non-standard situations. As part of the study of the discipline, interactive methods are used, the solution and analysis of situational problems, discussions, guest lectures by leading top managers of transport companies.	Applied Physics, Engineering Mathematics, Ecology and Life Safety	Labor protection, Management of locomotive operation processes, Traction theory and principles of energy saving, Final certification	OTOT
		EC2	Organization of operational work of the railway section				ON5, ON12	Study of the organization of the work of railway sections, dispatching personnel of railways, technical rationing of operational work and regulation of car traffic, locomotive and wagon fleets, rationing of work and rest of locomotive crews. Formation of skills for determining the operated fleet and calculating the operational indicators of the use of locomotives, operational planning of train and freight work of the road. As part of the discipline, demonstration of video clips is practiced, field classes are organized on the basis of the Almaty branch of the railway, Almaty-1, Almaty-2 stations.	Applied Physics, Engineering Mathematics, Ecology and Life Safety, Fundamentals of Economics and Entrepreneurship, Rolling stock and Railway Infrastructure	Management of locomotive operation processes, Traction theory and energy saving principles, Final certification	OTOT

1	2	3	4	5	6	7	8	9	10	11	12
Module 9 – Construction of locomotives	BD	EC1	Rolling stock and railway infrastructure	270	9	4	ON10, ON12	Formation of professional competencies in the field of construction and operation of a fleet of railway rolling stock in interaction with railway infrastructure facilities. Regulatory and technical base regulating requirements for railway rolling stock and elements of railway infrastructure; track and track facilities; railway power supply; design features of locomotives and wagons; locomotive, wagon facilities; rules technical operation; automation, telemechanics and communication on the railway; organization of transportation and train traffic.	Applied Physics, Engineering Mathematics, Structural materials in transport engineering, Theoretical mechanics	Methods of non-destructive testing of rolling stock, Dynamics of locomotives Organization of operational work of the railway section, Fundamentals of rolling stock reliability, Auto-braking of locomotives and traffic safety, Fundamentals of rolling stock design	RS
		EC2	Transport equipment and means of mechanization				ON10, ON12	The discipline studies the principles of operation, design features of transport equipment and means of mechanization, basic technical, operational, traction and energy characteristics, the role and significance of technical operation of various types of transport equipment. The discipline uses interactive teaching methods, conducting thematic surveys.	Applied Physics, Engineering Mathematics, Theoretical Mechanics	Energy installations of transport equipment, Locomotives	MV&LS
Module 8 - Electrical engineering, electronics, electrical equipment	PD	EC1	Electromagnetic technical means	180	6	5	ON2, ON8	Studies the design, principle of operation, classification and characteristics of electric machines and transformers of general industrial use, equations of EMF, voltages, currents and moments, methods of starting and regulating the frequency of electric motors, physical working conditions, losses and efficiency factor. The discipline contributes to the analysis of technical solutions to improve performance and the application of engineering methods for calculating the parameters of electric energy converters. Interactive teaching methods, case tasks, problem solving, test tasks are used.	Applied Physics, Engineering Mathematics, Electrical engineering and the basics of electronics, Structural materials in transport engineering, Power plants of transport equipment	Fundamentals of rolling stock reliability, Microprocessor-based locomotive automatic control Systems, Locomotive repair technology	RS

1	2	3	4	5	6	7	8	9	10	11	12
		EC2	Electrical power transmissions				ON8, ON10	Studies the schematic diagrams of the power transmission of operating locomotives, the device and principles of operation of traction electric machines, as well as the schematic power circuits and adjustment characteristics of electrical, mechanical and hydraulic transmissions. The main power contact devices for controlling locomotives and the principle of controlling a locomotive from the driver's console are described. Interactive teaching methods, case tasks, calculation of characteristics of traction electric machines, test tasks are used.	Engineering Mathematics, Applied Physics, Electrical Engineering and Fundamentals of Electronics	Microprocessor-based locomotive automatic control systems, Locomotives, Locomotive Auto brakes and traffic safety, Traction theory and energy saving principles	RS
Module 11 - Operation of locomotives	PD	EC1	Management of locomotive operation processes	270	9	8	ON6, ON11, ON12	Studies the basics of the organization of operation and maintenance of locomotives, the methodology for calculating the indicators of the use of rolling stock, the basics of scientific organization of work of locomotive crews, the basic principles of highly efficient use of locomotives. When studying the discipline, elements of dual training are used - the study of individual modules is provided on the basis of branches of the department at specialized enterprises. Interactive teaching methods, case tasks, problem solving, test tasks are used.	Engineering Mathematics Applied Physics Occupational safety, Traffic safety in transport, Organization of operational work of the railway section, Rolling stock and railway infrastructure, Locomotives, Locomotive braking and traffic safety, Traction theory and principles of energy conservation, Managerial economics, Transport logistics	Production practice 2, Final certification	RS
Module 5 - Ecology and life safety		EC2	Environmental management in transport				ON5, ON6	Studies ensuring the effectiveness of activities with rational use of natural resources and the minimum possible pollution of the environment, economic and administrative mechanisms aimed at the development of nature and society with the goals of maintaining a stable balance of ecosystems, a process management system aimed at ensuring regulatory social, environmental and economic parameters, managerial decision-making.Interactive teaching methods, case tasks, problem solving, test tasks are used.	Ecology and life safety, Fundamentals of Economics and Entrepreneurship, Labor protection	Production practice 2, Final certification	RS

1	2	3	4	5	6	7	8	9	10	11	12
Module 11 - Operation of locomotives	PD	EC1	Traction theory and principles of energy saving	180	6	7	ON10, ON12	The study of the theoretical foundations of the processes of traction force formation, methods for calculating the resistance to movement and braking of the train, the basic equation of train movement and methods of its solution, traction calculations. Mastering students' knowledge in the field of rationing the consumption of energy resources by locomotives for train traction, rational modes of train driving and features of the movement of heavy and long-component trains. Interactive teaching methods, case tasks, problem solving, test tasks are used.	Engineering Mathematics, Applied Physics, Traffic safety in transport, Organization of operational work of the railway section, Rolling stock and infrastructure of railways, Locomotives, Locomotive brakes and traffic safety	Management of locomotive operation processes, Production practice 2, Final certification	RS
Module 10 - Reliability, diagnostics and repair of locomotives		EC2	Automation of technological processes				ON4, ON11	The discipline forms the ability to solve problems of automation of production processes using modern technical means. Studies automated process control systems; information systems of automated process control systems; fundamentals of modeling of technological objects, controlled automated process control systems; structure and algorithms of process control, software control systems of production installations.	Information and communication technologies, Electrical engineering and fundamentals of electronics, Theory of automatic control, IT technologies in transport	Locomotive repair technology, Locomotive operation process management, Production Practice 2, Final certification	RS
Module 6 - Economic and managerial competencies	PD	EC (Minor 1)	Managerial Economics (Minor)	90	3	5	ON6	The study of the main provisions of transport support of logistics systems, activities in the field of transportation, covering the entire range of operations and services for the delivery of goods from the manufacturer of products to the consumer, the principles of design and construction of logistics systems. Mastering the skills of optimization and organization of rational cargo flows, their processing in specialized logistics centers, ensuring an increase in their efficiency, reducing unproductive costs and expenses. The teaching methods are: solving problems, conducting thematic colloquiums, seminars "brainstorming". Within the framework of the discipline, guest lectures are conducted by leading specialists of transport and logistics companies.	Engineering Mathematics, Fundamentals of Economics and Entrepreneurship	Final certification	TLM

1	2	3	4	5	6	7	8	9	10	11	12
		EC (Minor 2)	Transport logistics (Minor)	90	3	6	ON2, ON6	The study of the main provisions of transport support of logistics systems, activities in the field of transportation, covering the entire range of operations and services for the delivery of goods from the manufacturer of products to the consumer, the principles of design and construction of logistics systems. Mastering the skills of optimization and organization of rational cargo flows, their processing in specialized logistics centers, ensuring an increase in their efficiency, reducing unproductive costs and expenses. The teaching methods are: solving problems, conducting thematic colloquiums, seminars "brainstorming". Within the framework of the discipline, guest lectures are conducted by leading specialists of transport and logistics companies.	Engineering Mathematics	Final certification	TLM
Module 11 - Operation of locomotives		EC (Minor 3)	Resource saving in transport (Minor)	90	3	7	ON11, ON12	The study of the main types and characteristics of energy resources, regulatory and legal support for energy conservation, improving the energy efficiency of the transportation process; energy-saving technologies in repair production and operation of railway infrastructure facilities; organization and methods of energy conservation management. They are used to solve problems, conduct thematic colloquiums, debates. Guest lectures are being held by leading experts of the transport and communication industry.	Applied Physics, Engineering Mathematics, Ecology and life safety	Locomotive repair technology, Management of locomotive operation processes, Final certification	RS
Module 6 - Economic and managerial competencies	PD	EC (Minor 1)	Time - management (Minor)	90	3	5	ON6	Formation of students' general ideas about the essence and types of time management, principles and methods of time resource management for more successful professional activities. Active learning methods are used - situational tasks, case method.	Engineering Mathematics	Final certification	TLM
Module 4 -IT competencies		EC (Minor 2)	Fundamentals of rolling stock design (Minor)	90	3	6	ON4, ON10	Systematize traditional methods and modern software systems for automated design of wagons and locomotives. Determine the optimal parameters of the rolling stock and its linear dimensions. Apply modern methods of developing design documentation when designing components and parts of CAD rolling stock and CAD applications: QCAD, FreeCAD, etc.).	Applied Physics, Engineering Mathematics, Theoretical Mechanics, Machine parts and design basics, Rolling stock and railway infrastructure, Locomotives	Final certification	RS

1	2	3	4	5	6	7	8	9	10	11	12
		EC (Minor 3)	PowerBI Business Analytics (Minor)	90	3	7	ON4, ON6	Formation of students' skills and knowledge to collect, analyze and structure data in order to build interactive dashboards, program at the modern level of development of the MDX multidimensional data analysis language, build models and algorithms of projects in relevant areas of BI technology, be able to analyze the essence of the project subject field and make decisions. Methods of active learning are used - brainstorming, working in small groups. The form of control is an individual project.	Engineering mathematics, Information and communication technologies, IT technologies in transport	Final certification	ICT
Total:				2580	86						

Head of the Department "Rolling stock" Ashirbayev G.K.