MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF KAZAKHSTAN
NLC «KARAGANDA UNIVERSITY OF THE NAME OF ACADEMICIAN E.A. BUKETOV»
NLC «Karaganda University of the name of academician E.A. Buketov»

«AGREED » by
Director of the KazMIRD Institute
at Abylkas Saginov KTU NJSC
_____ Nuguzhinov Zh.S.
28.03 2022

«APPROVED » by
NLC «Karaganda University
of the name of academician E.A. Buketov»
Chairman of the Board – Rector
_____ Dulatbekov N.O.
26.03 2022

«AGREED» by
Laboratory at KarU
of the name of academician E.A. Buketov
«Robotics and Intelligent Machines»
_____ Zinoviev L.A.
28.03 2022

EDUCATIONAL PROGRAM

«7M05402 - Mechanics»

Educational level: Master's degree

Karaganda, 2022

The educational program of the specialty "7M05402 - Mechanics" was developed on the basis of:

– the Law of the Republic of Kazakhstan from July 27, 2007 No. 319-III “On Education”

- the Order of the Minister of Education and Science of the Republic of Kazakhstan from August 31, 2018 No. 604 "State obligatory standard of the higher education"

– the Order of the Minister of Education and Science of the Republic of Kazakhstan No. 152 from April 20, 2011 “On approval of the Rules for organizing the educational process on credit technology of education”

- "Classifier of the areas for training personnel with higher and postgraduate education", approved by order of the Minister of Education and Science of the Republic of Kazakhstan No. 569 from October 13, 2018.

Content

Passport of the educational program

1 Code and name of the educational program: 7M05402 - Mechanics

2 Code and classification of the field of education, domains of study
The field of education: 7M05 - Natural sciences, mathematics and statistics
The domain of study: 7M054 - Mathematics and statistics

3 Group of educational programs: M093 – Mechanics, 7M054 - Mathematics and statistics

4 Volume of credits: 120 academic credits

5 Form of study: full-time

6 Language of instruction: Kazakh, Russian

7 Degree awarded: Master of Natural Sciences in the educational program «7M05402 – Mechanics»

8 EP type: ongoing

9 Level according to the ISCE: 7th level

10 Level according to the NQF: 7th level

11 Level according to the SQF: 7th level

12 Distinctive features of the EP
Partner university (JEP) - no
Partner university (DDEP) - no

13 Application number to the license for the direction of personnel training
License KZ83LAA00018495, Appendix No. 016 dated July 28, 2020

14 The name of the accreditation body and the validity period of the accreditation of the EP

Certificate of specialized accreditation SA No. 0039/1 of the IQAA agency 12/27/2014 – 12/26/2019.

15 The purpose of the EP

Preparation of masters of natural sciences in mechanics, possessing fundamental knowledge in the field of theoretical and applied mechanics, mathematics, owning modern methods of modeling and programming for their implementation in scientific, pedagogical and production activities.

16 Qualification characteristics of the graduate

a) List of graduate positions

- teacher of the disciplines of mechanical and mathematical cycles, including computer science, in higher school;
- research associate in research and calculation and experimental centers;
- engineer in research and production and manufacturing enterprises;
- software engineer in research and production organizations.
- analyst, logistician, developer, designer, tester, technologist in scientific and industrial organizations.

b) Scope and objects of professional activity for the graduate

The scope of professional activity for graduates on the educational program «7M05402 - Mechanics» are:

the field of education and science:

- teaching of disciplines of mechanical and mathematical cycles in secondary professional and higher educational institutions;
- teaching theoretical mechanics, mathematics, computer science in secondary schools;
- scientific and pedagogical activity in the field of education and science;
- research and calculation and experimental activities in the field of mechanics and technical sciences in scientific centres;
- design and production and technological activities in research and production organizations;
- the activities of the developer in the compilation and implementation of software systems for applied problems of mechanics using modern means of computer technology;

the field of production:

- engineering activities in research and production and manufacturing enterprises;
- consulting and expert activities in research and production and manufacturing organizations;
- organizational and management activities in scientific-production and production centres;

the social field:

- administrative and management activities as a consultant, analyst, specialist of administrative bodies.

The objects of professional activity of masters on the educational program «7M05409301 - Mechanics» are:

- scientific and research centers;
- design and testing institutions;
- scientific and production organizations;
- educational institutions;
- governing bodies;
- design and technological services;
- enterprises of industrial production;
- organizations of various forms of ownership.

c) Types of professional activity of the graduate
- scientific and research;
- calculation and experimental;
- educational;
- scientific and pedagogical;
- design and engineering;
- production and technological;
- administrative and managerial;
- scientific and innovative;
- consulting and expert;
- organizational and management.

d) Functions of the graduate's professional activity
- teaching;
- research activities;
- design;
- modeling;
- construction;
- conducting experiments;
- software support;
- management.

Formulation of learning outcomes based on competencies

Type of competencies	Learning outcome code	Learning outcome (according to Bloom's taxonomy)
1. Behavioral skills and personal qualities: (Softskills)	LO 1	Owns the principles of the organization of training, demonstrates knowledge of applied philosophical, pedagogical, psychological and natural science disciplines that contribute to the implementation of the main directions of modernization of public consciousness. In his professional activity, he takes an active civic position on the priorities of competitiveness, pragmatism, mutual understanding, tolerance and democratic values of modern society.
	LO 2	Owns the basic concepts of the philosophy of science for solving problems in the field of scientific research fluently; substantiates the modern paradigm of higher education, demonstrates knowledge in the field of modern educational technologies and applies them in practice, demonstrates readiness for communication to solve problems in the field of management psychology, owns methods of commercialization as one of the profiles of the activities of state bodies, taking into account social, ethical and scientific interests in the field of professional activity.
	LO 3	Knows general, business and professional vocabulary of a foreign language to the extent necessary for professional communication, knows professional terminology and the basics of reading and translating English scientific and technical literature on mechanics, has the skills of oral and written English-language communication in the professional field of mechanics, carries out professional scientific communication for international cooperation in this subject area.
2. Digital competencies: (Digital skills)	LO 4	Possesses digital literacy in the use of digital technologies and tools for working with information, has awareness of the latest technologies and knowledge of innovative methods of working in the field of digital technologies; demonstrates readiness for the implementation of information, communication and digital technologies in educational, professional and scientific activities.
	LO 5	Has programming skills, creates information and software using standard design solutions, develops software systems using modern computer technology.
	LO 6	Applies the studied digital technologies, tools for working with information, standard programs, acquired knowledge and programming skills for conducting scientific research and solving professional problems using computer tools, constantly studies modern innovative methods of work in the field of digital technologies and use them in practice, understands the needs of introducing digital technologies into scientific and professional activities.
3. Professional competencies: (Hardskills)	LO 7	Knows the formed and systemic theoretical apparatus of the disciplines of mechanics (basic key elements and definitions, theoretical positions and statements, techniques and research methods), conducts and explains the proofs of statements, gives examples, analyses, evaluates and compares various theoretical concepts, draws conclusions.
	LO 8	Knows the basic methods for solving typical practical problems of mechanics and applies them in the study and solution of problems of a mechanical, natural-science nature and interdisciplinary areas; selects the direction of research and methods for solving problems, practically implements the solution of the problem in the chosen way, performs computational calculations if necessary, depicts the solution scheme, studies the properties of the solutions obtained, generalizes the final results, draws conclusions.
	LO 9	Owns the principles of mathematical, numerical and experimental modeling of real mechanical and natural science processes, translates real processes into mathematical and experimental models, works with abstract objects, knows how to check the adequacy of a theoretical model, justifies the choice and application of methods, techniques and typical design solutions for the study of mathematical, numerical and experimental models of mechanics.
	LO 10	Possesses basic knowledge in the field of celestial mechanics and aerodynamics as the theoretical basis of aviation and rocket technology; conducts research on the laws of movement for air flows and their interaction with obstacles and moving bodies, mathematically processes the results of the study; selects and uses optimal methods for solving practical problems; analyses and applies knowledge and understanding of facts, phenomena, theories and complex dependencies in celestial mechanics.
	LO 11	Demonstrates knowledge and understanding in the field under study, including elements of the most advanced trends in applied mechanics; substantiates the essence, methodology of application, advantages and disadvantages of various methods of applied mechanics; implements the studied methods, formulates arguments and solves professional problems of applied mechanics; consciously plans the educational proc-

		esses necessary for independent continuation of further education in the field under study.
	LO 12	Conducts independent scientific activity in the study and solution of the scientific problem posed (plans, develops and corrects the complex process of scientific research based on the studied theories of mechanical disciplines and analysis methods); solves complex scientific and technical problems of mechanics, carries out their experimental testing; evaluates current research directions in mechanics, taking into account world trends in the development of science, engineering and technologies; is able to generate his own new scientific ideas, implements proofs, solutions, calculations and a comprehensive analysis of the results obtained.

Determination for modules of disciplines in accordance with the learning outcomes

Learning outcome code	Module name	Names of disciplines	Volume (ECTS)
LO 1 – LO 3, LO 7	Philosophical and historical aspects of social and humanitarian knowledge	History and philosophy of science	4
LO 1 – LO 3, LO 8		Higher school pedagogy	4
LO 1 – LO 3, LO 9		Management psychology	4
LO 1 – LO 3, LO 8		Pedagogical practice	4
LO 1, LO 2, LO 10	Professional languages	Foreign language (professional)	4
LO 1, LO 2, LO 10, LO 12		Professional terminology and basics of English scientific and technical literature translation on mechanics (in English)	5
LO 1, LO 2, LO 10, LO 12		Basics of writing scientific papers on mechanics (in English)	
LO 1 – LO 3, LO 11	Modern questions of science and technique	High-tech innovative entrepreneurship	5
LO 1 – LO 3, LO 11		Commercialization of the results of scientific and technical activities	
LO 1, LO 12		Nonlinear continuum mechanics	5
LO 1 – LO 3, LO 8, LO 12		Innovative methods in teaching mechanics	
LO 1, LO 10, LO 12	Theoretical mechanics	Actual problems of classical mechanics (in English)	4
LO 1, LO 12		Fundamentals of aerodynamics	4
LO 1, LO 12		The basic problems and methods of celestial mechanics	
LO 1, LO 4 – LO 6, LO 12	Technical mechanics	Methods of the building structures calculation	4
LO 1, LO 4 – LO 6, LO 12		Mechanics of machines and robotic systems	4
LO 1, LO 12		Fundamentals of the theory of elasticity and plasticity	4
LO 1, LO 12		Selected questions of the plates anSelected questions of the plates and shells theory	
LO 1, LO 4 – LO 6, LO 10, LO 12		Design of composite materials and structures in mechanics (in English)	5
LO 1, LO 10, LO 12		Fracture mechanics, basics and applications (in English)	
LO 1, LO 12	Computational mechanics	Additional chapters of fluid dynamics	4
LO 1, LO 12		Additional chapters of fluid and gas mechanics	
LO 1, LO 10, LO 12		Lagrangian mechanics and nonholonomic systems (in English)	4
LO 1, LO 4 – LO 6, LO 10, LO 12		Modeling the processes of solids deformation (in English)	
LO 1, LO 10, LO 12		Hamiltonian mechanics and qualitative features of body motion (in English)	4
LO 1, LO 4 – LO 6, LO 10, LO 12		Computer mechanics (in English)	
LO 1 – LO 6		Research	12
LO 1 – LO 6	Research work	Undergraduate research work, including internship and master thesis (URWIIMT)	24
LO 1 – LO 6	Final examination	Registration and defence of master	12

Achievability matrix of learning outcomes

№	Name of disciplines	Brief description of the discipline	Number of credits	Forming learning outcomes (codes)											
				LO 1	LO 2	LO 3	LO 4	LO 5	LO 6	LO 7	LO 8	LO 9	LO 10	LO 11	LO 12
Cycle of basic disciplines University component															
D1	History and philosophy of science	The purpose of mastering the discipline is to study the general laws of scientific knowledge in the history and philosophy of science, in its historical development and in a changing socio-cultural context. This course contains the following questions: philosophy and methodology of science, science as a cognitive activity, science in the culture of modern civilization, features of scientific knowledge, functions of science in society, historical development of institutional forms of scientific activity, changing the place and role of science in society.	4	+	+	+				+					
D2	Higher school pedagogy	The purpose of studying the discipline is to form knowledge about the theoretical foundations of pedagogy and management of the learning process in higher education. This course covers such issues as the essence of pedagogy as a science; the features of the pedagogical process of higher education, the essence of the processes of development, education, formation and socialization of personality; the properties of the learning process; the main characteristics of modern pedagogical technologies; the structure of the education system in the Republic of Kazakhstan.	4	+	+	+					+				
D3	Psychology of management	The purpose of studying the discipline is the formation of systemic ideas among undergraduates about the psychological patterns of managerial activity; mastering the skills of analysing the socio-psychological principles underlying effective management. Course content is establishment of cause-and-effect relationships in management psychology; comprehension of psychological phenomena; creative application of psychological knowledge in practice; mastering knowledge about a person as a psychological system; disclosure of the specifics of	4	+	+	+						+			

		the use of socio-psychological knowledge in the management structure.													
D4	Foreign language (professional)	The purpose of studying the discipline is the formation of intercultural communicative competence in the process of foreign language education at a sufficient level, taking into account the needs of undergraduates in learning a foreign language dictated by the peculiarities of the future profession and specialty. The essence of professionally-oriented foreign language teaching is its integration with special disciplines in order to obtain additional professional knowledge. According to the discipline, methods and means of mastering business speech skills in the professional sphere of communication are studied.	4	+	+								+		
Cycle of basic disciplines The electoral component															
D5	Professional terminology and basics of English scientific and technical literature translation on mechanics (in English)	The purpose of mastering the discipline is to obtain fundamental knowledge of professional foreign terminology in mechanics, as well as the formation of skills for their use in the professional sphere. The main issues studied in the discipline are professional scientific and technical terminology on mechanics; the main grammatical phenomena of scientific, professional and business style, taking into account their oral and written forms; study of the main types, principles and features of the translation of technical literature on mechanics; study of general scientific and business vocabulary.	5	+	+								+		+
	Basics of writing scientific papers on mechanics (in English)	The purpose of studying the discipline is to develop competencies among undergraduates aimed at developing the readiness and ability to implement their own research projects and present their results in writing in accordance with the norms of the international academic community. This course contains the following questions: classification and features of functional styles in English; basic principles of writing official documents; writing articles on mechanics, preparing presentations		+	+								+		+

		and reports on mechanics for scientific conferences, seminars, symposiums, etc.													
D6	High-tech innovative entrepreneurship	The purpose of mastering the discipline is to gain knowledge of modern approaches and trends in the management of strategic planning and management of high-tech industries. The course covers the following issues: strategic planning and management of high-tech industries, modern approaches and trends in the management of high-tech investment design, the basics of organizing high-tech production, organizational structures for managing high-tech enterprises at the present stage, modern methods and management standards for high-tech production.	5	+	+	+								+	
	Commercialization of the results of scientific and technical activities	The course is studied with the aim of teaching the basics of commercialization of the results of scientific research. The course covers the following issues: the legal framework for the commercialization of the results of scientific and scientific and technical activities, the legal mechanisms for the protection of intellectual property, the technology for commercializing the results of scientific and scientific and technical activities, the content and goals of business planning of the project for the commercialization of the results of scientific and scientific and technical activities, the rights and obligations of the authors of the results of scientific and scientific and technical activities.		+	+	+								+	
D7	Nonlinear continuum mechanics	The purpose of mastering the discipline is to obtain basic knowledge on theoretical problems arising during the movement of a continuous medium, and the formation of skills and abilities to apply approaches, methods and models of nonlinear continuum mechanics when performing scientific and practical work. The discipline covers the following sections: fundamentals of nonlinear continuum mechanics, continuum kinematics, conservation laws, theory of jumps of functions on surfaces of strong breaks, dynamic equations of compatibility of deformations, formulation of defining relations for elastic and inelastic media with finite deformations.	5	+											+
	Innovative methods in teaching mechanics	The purpose of mastering the discipline is the formation of competencies among undergraduates in the process of studying the basics of innovative activity of a teacher-mechanic, mastering the methods of diagnosing a teacher's readiness for innovative activity and technologies for preparing a teacher to work in the system of innova-		+	+	+					+				+

		tive education. The discipline contains the theoretical foundations of pedagogical innovative methods and technologies (main aspects; the essence of the technological approach), general trends in the development of innovative processes, the content and structure of innovative activities of teachers in teaching mechanics.													
Cycle of profile disciplines University component															
D8	Actual problems of classical mechanics (in English)	The purpose of studying the course is to obtain basic knowledge on the general methods of studying arbitrary classical dynamic systems, and to develop an understanding of fundamental physical ideas and mathematical methods of classical mechanics among undergraduates. The course contains the following issues: study of conservative systems that preserve values; rigid body motion and rotational dynamics; forced and small oscillations; movement in a resisting medium; impulse forces, conservative forces; special theory of relativity; vibration systems.	4	+									+		+
D9	Methods of the building structures calculation	The purpose of the discipline is to study the basic characteristics, requirements and calculation methods for building structures. The discipline contains elements of the theory of strength, dynamics and stability of building structures, complex resistance, strength under variable stresses, design schemes of structures, methods for determining internal forces, the method of simple sections, the method of joint sections, the method of cutting a node, the method of replacing links, kinematic analysis of systems, the method of forces, discrete method, method of displacement, finite element method.	4	+			+	+	+						+
D10	Mechanics of machines and robotic systems	The purpose of studying the discipline is to form the competence of the students in the field of application and development of robotic complexes and organization of automated production based on industrial robots. The discipline studies the structure, arrangement and classification of industrial robots; calculated kinematic model, tasks of kinematic research; program control systems and information systems of machines and robotic systems; remotely controlled machines, robots and manipulators; principles of designing machines and robotic systems.	4	+			+	+	+						+
Cycle of profile disciplines The electoral component															
D11	Fundamentals of aerodynamics	The purpose of the discipline is to study the patterns of	4	+											+

		movement of air flows and their interaction with obstacles and moving bodies. The purpose of studying the discipline is to teach undergraduates to carry out aerodynamic calculations of mechanical systems and apply the methods of aerodynamic analysis. The discipline contains the following issues: characteristics of flows; patterns of movement of air flows and their interaction with obstacles and moving bodies; study of gas dynamics, problems of aerodynamics when bodies move at speeds close to or exceeding the speed of sound.														
	The basic problems and methods of celestial mechanics	The purpose of mastering the discipline is to study the laws of unperturbed and perturbed motion of celestial bodies and artificial satellites of the earth, methods for solving the equations of motion of the bodies of the solar system and methods for determining their orbits. The discipline covers the following sections: undisturbed and perturbed motions, integrals of relative motion, integrals of equations of absolute motion; equations of barycentric motion, Keplerian elements of the orbit, elliptic, hyperbolic and parabolic motions, classical integrals in the problem of many bodies, Hill surfaces.		+												+
D12	Fundamentals of the theory of elasticity and plasticity	The purpose of mastering the discipline is to prepare the future master to conduct independent calculations of structures based on a competent analysis of the stress-strain state of bodies under various influences. The discipline contains the following questions: the basic laws of the classical theory of elasticity and the theory of plasticity; deformations in a solid caused by physical influences, and the resulting internal forces, both at rest and in motion; computational models of materials reflecting the specifics of their deformation under load.	4	+												+
	Selected questions of the plates anSelected questions of the plates and shells theory	The purpose of studying the discipline is to master the necessary knowledge and skills in the field of the theory of plates and shells, as well as the acquisition of skills in calculating thin-walled spatial structures for strength, stability and vibrations using analytical and numerical methods. The discipline is intended for an in-depth study of cylindrical and spherical bending, compression and shear of the plate; shallow, compound shells and shells of revolution; the study of the calculation of forces and moments in the plate, the calculation of displacements and forces in the shell, the calculation of shells under various types of loading.		+												+
D13	Design of composite materials	The purpose of studying the discipline is the formation	5	+			+	+	+				+		+	

	and structures in mechanics (in English)	of basic knowledge about the main methods of designing and developing structures from composites used to manufacture various structures. The objectives of the discipline are to familiarize with the basic information about composite materials of various nature; the main methods of design, development, manufacture and assembly of structures from composites. The course includes such sections as the effect of orientation on stiffness and strength, fibrous composites, laminates, membrane stresses, thickness effects, edge effects, three-dimensional analysis.													
	Fracture mechanics, basics and applications (in English)	The purpose of studying the discipline is to form undergraduates' theoretical knowledge and practical skills necessary to solve specific applied strength problems at the scientific level, ensuring the adequacy of the solutions obtained. The course covers the following issues: strength and resistance to fracture; classical and non-classical fracture schemes; force approach in fracture mechanics; stresses at the crack contour; plastic zone at the crack tip; crack growth conditions; fatigue failure of the material; calculation of structural elements for durability.		+									+		+
D14	Additional chapters of fluid dynamics	The purpose of studying the discipline is to develop the ability of undergraduates to understand key aspects and concepts in the field of modern hydrodynamics; to plan and conduct scientific and theoretical research in this field. The discipline provides an expanded study of the hydrodynamics of a viscous incompressible fluid, viscous flow at small Reynolds numbers, laminar flow at large Reynolds numbers, hydrodynamic instabilities and turbulence, heat transfer under forced convection, free convection of fluid without internal heat sources.	4	+											+
	Additional chapters of fluid and gas mechanics	The purpose of mastering the discipline is the formation of knowledge of the general laws and equations of statics, kinematics and dynamics of fluids and gases; flows of incompressible and compressible flows of ideal and real fluids, research methods for their application in professional activities. The discipline provides an extended study of models of fluid and gaseous media, the equation of state of matter, isentropic formulas and gas-dynamic functions, local hydraulic resistance, hydrodynamic and dynamic similarity, the main characteristics of the outflow of fluid through holes and nozzles.		+											+
D15	Lagrangian mechanics and	The purpose of mastering the discipline is to prepare	4	+									+		+

	nonholonomic systems (in English)	undergraduates to conduct independent calculations based on the principles of Lagrangian mechanics. In Lagrangian mechanics, the trajectory of an object is obtained by finding a path that minimizes the action. The discipline includes the study of the following topics: fundamentals of Lagrange mechanics, the principle of stationary action, configuration spaces, finding trajectories that minimize action, Euler-Lagrange equations and their derivation, finding Lagrangian, Hamilton's principle, systems with rigid constraints, Noether's theorem, nonholonomic systems.													
	Modeling the processes of solids deformation (in English)	The purpose of mastering the discipline is the study by undergraduates of modern models of deformation of solids, for which the main hypotheses underlying the class models of deformation of solids take place. The discipline studies the basic principles of modeling deformation processes; qualitative and quantitative, discrete and continuous, analytical and numerical models; round shaft torsion, pure shear and energy transfer, mechanical diagrams; study of the Levy problem - a triangular dam, the Kirsch problem - a round hole, the Boussinesq problem, linear and nonlinear models.		+			+	+	+				+		+
D16	Hamiltonian mechanics and qualitative features of body motion (in English)	The purpose of studying the discipline is to form undergraduates' knowledge of the basic provisions and laws of Hamiltonian mechanics, to gain skills in applying canonical transformations to solve and analyze problems of mechanics. The discipline includes the study of the following topics: kinetic energy of rotation, representation of the angular velocity vector, Euler angles, qualitative features of free motion of a rigid body, spin-orbital coupling, development of potential energy, Euler equations, non-degenerate generalized coordinates, fundamentals of Hamiltonian mechanics, Hamilton equations from the principle of action, Poisson brackets.	4	+									+		+
	Computer mechanics (in English)	The purpose of mastering the discipline is to study analytical and numerical methods for solving problems of mechanics, which are the basis of applied systems of automated engineering analysis, to increase the level of professional competence in solving problems of mechanics with the help of computer technologies. The discipline presents mechanical analysis of the processes under study; comparison of numerical and analytical solutions modeling of processes, such as hydraulic fracturing in the field of high residual loads, etc.; application of perturbation theory, features of the software imple-		+			+	+	+				+		+

		mentation of the finite element method, applications in mechanics.														

Coordination of the planned learning outcomes with teaching and assessment methods within the module

Learning outcomes	Planned learning outcomes for the module	Teaching methods	Methods of assessments
LO 1	Owns the principles of the organization of training, demonstrates knowledge of applied philosophical, pedagogical, psychological and natural science disciplines that contribute to the implementation of the main directions of modernization of public consciousness. In his professional activity, he takes an active civic position on the priorities of competitiveness, pragmatism, mutual understanding, tolerance and democratic values of modern society.	Discussion Round table Oral presentation	Quick survey Paper Essay writing
LO 2	Owns the basic concepts of the philosophy of science for solving problems in the field of scientific research fluently; substantiates the modern paradigm of higher education, demonstrates knowledge in the field of modern educational technologies and applies them in practice, demonstrates readiness for communication to solve problems in the field of management psychology, owns methods of commercialization as one of the profiles of the activities of state bodies, taking into account social, ethical and scientific interests in the field of professional activity.	Discussion Round table Oral presentation	Project preparation Quick survey Paper
LO 3	Knows general, business and professional vocabulary of a foreign language to the extent necessary for professional communication, knows professional terminology and the basics of reading and translating English scientific and technical literature on mechanics, has the skills of oral and written English-language communication in the professional field of mechanics, carries out professional scientific communication for international cooperation in this subject area.	Learning by experience Discussion Round table	Paper Quick survey Essay writing
LO 4	Possesses digital literacy in the use of digital technologies and tools for working with information, has awareness of the latest technologies and knowledge of innovative methods of working in the field of digital technologies; demonstrates readiness for the implementation of information, communication and digital technologies in educational, professional and scientific activities.	Method of illustrations and demonstrations Learning by experience Interactive lecture	Exercises Paper Test
LO 5	Has programming skills, creates information and software using standard design solutions, develops software systems using modern computer technology.	Problem-based learning Learning by experience Perspective learning	Practical work using digital technologies Paper, Test
LO 6	Applies the studied digital technologies, tools for working with information, standard programs, acquired knowledge and programming skills for conducting scientific research and solving professional problems using computer tools, constantly studies modern innovative methods of work in the field of digital technologies and use them in practice, understands the needs of introducing digital technologies into scientific and professional activities.	Research method Perspective learning Project-based learning	Creative work using digital technologies Paper Presentation
LO 7	Knows the formed and systemic theoretical apparatus of the disciplines of mechanics (basic key elements and definitions, theoretical positions and statements, techniques and research methods), conducts and explains the proofs of statements, gives examples, analyses, evaluates and compares various theoretical concepts, draws conclusions.	Perspective learning Interactive lecture Discussion	Written work Test Quick survey
LO 8	Knows the basic methods for solving typical practical problems of mechanics and applies them in the study and solution of problems of a mechanical, natural-science nature and interdisciplinary areas; selects the direction of research and methods for solving problems, practically implements the solution of the problem in the chosen way, performs computational calculations if necessary, depicts the solution scheme, studies the properties of the solutions obtained, generalizes the final results, draws conclusions.	Case Methods Interactive lecture Discussion	Essay writing Test Oral survey
LO 9	Owns the principles of mathematical, numerical and experimental modeling of real mechanical	Analysis and solution of problem situa-	Report

	and natural science processes, translates real processes into mathematical and experimental models, works with abstract objects, knows how to check the adequacy of a theoretical model, justifies the choice and application of methods, techniques and typical design solutions for the study of mathematical, numerical and experimental models of mechanics.	tions Learning by experience Round table	Paper Essay writing
LO 10	Possesses basic knowledge in the field of celestial mechanics and aerodynamics as the theoretical basis of aviation and rocket technology; conducts research on the laws of movement for air flows and their interaction with obstacles and moving bodies, mathematically processes the results of the study; selects and uses optimal methods for solving practical problems; analyses and applies knowledge and understanding of facts, phenomena, theories and complex dependencies in celestial mechanics.	Immersion method Interactive lecture Practical work	Katanotest Test Written control
LO 11	Demonstrates knowledge and understanding in the field under study, including elements of the most advanced trends in applied mechanics; substantiates the essence, methodology of application, advantages and disadvantages of various methods of applied mechanics; implements the studied methods, formulates arguments and solves professional problems of applied mechanics; consciously plans the educational processes necessary for independent continuation of further education in the field under study.	Business games Interactive lecture Practical work	Context task Test Written control
LO 12	Conducts independent scientific activity in the study and solution of the scientific problem posed (plans, develops and corrects the complex process of scientific research based on the studied theories of mechanical disciplines and analysis methods); solves complex scientific and technical problems of mechanics, carries out their experimental testing; evaluates current research directions in mechanics, taking into account world trends in the development of science, engineering and technologies; is able to generate his own new scientific ideas, implements proofs, solutions, calculations and a comprehensive analysis of the results obtained.	Interactive lecture Practical work Analysis, solution and calculation of tasks	Test Colloquium Written control

Criteria for assessing the achievability of learning outcomes

Codes of LO	Criteria
LO 1	**Can:** freely master new operations, methods and technologies for him to perform his professional duties, constantly improves, updates and replenishes his special knowledge and skills, constructively introduces new knowledge into work.
	Owns: the ability to independently determine the tasks of professional and personal development, self-education classes; the ability to consciously plan the process of advanced training and professional self-improvement.
LO 2	**Knows:** has an idea about ethical, spiritual and cultural values, about national traditions of different ethnic, racial and national groups, about the attitudes of society, about the main patterns and forms of regulation of social behaviour, about sociological approaches to personality, about cultural and cultural-specific knowledge, about the symbols of the state (coat of arms, flag, anthem, etc.).
	Can: perceive life habits, mores, customs, forms of behaviour, non-verbal components (gestures and facial expressions), national and cultural traditions, value systems of other peoples; behave in accordance with the values of foreign-speaking people, their attitudes and traditions; work in a team, accept social and ethical obligations, understand and respect the rights and duties of a citizen of the Republic of Kazakhstan.
	Owns: the skill to perceive the diversity of cultures and intercultural differences; the ability to successfully communicate with representatives of different cultures and nationalities; social skills related to the processes of social interaction and cooperation; the skill to work in an international context; the ability to fulfil one's civic duty.
LO 3	**Can:** identify sources of necessary and objective information, systematically analyze them, draw logical conclusions, and then make decisions taking into account time frames and business priorities; when making a decision, takes responsibility for his actions and the actions of his colleagues and subordinates; is capable of setting professional goals and choosing strategies to achieve them.
	Owns: ability to make decisions and implement goals, self-regulation, endurance, initiative and determination; has a personal business quality, a skill, a behaviour model, possession of which helps to successfully solve a certain business problem and achieve high results.
LO 4	**Knows:** the basic set of information and digital environment tools that are necessary for the safe and effective use of digital technologies and Internet resources.
	Can: solve various tasks in the field of information and communication technologies: use and create content using digital technologies, including search and exchange of information, answers to questions, and interaction with other people.
	Owns: digital skills that allow creating and sharing digital content, communicating and solving problems for effective and creative self-realization in education, work and social and professional activities.
LO 5	**Knows:** basics of programming, principles of algorithmization, properties and methods of describing algorithms, commands, programming languages, principles of software construction and stages of software product development.
	Can: develop stages of solving problems on a PC, apply structural and modular programming; use standard software applications; design, test and debug the created software product.
	Owns: the ability to plan and develop sequential commands for programming analytical and computing systems, the skills to create software products to perform specific professional tasks.
LO 6	**Knows:** has awareness of the latest digital technologies, knows innovative methods of working in the digital environment and methods of their practical implementation.
	Can: select the necessary digital tools and software products for conducting scientific research and solving professional problems and customize digital environments for personal needs; uses modern innovative methods of work in the field of digital technologies in its research activities.
	Owns: well-established, automated behaviour models based on knowledge and skills in the use of digital devices, communication applications and networks, programming skills for conducting scientific research and solving problems in the professional field.
LO 7	**Knows:** general patterns of scientific knowledge in its historical development and in a changing socio-cultural context; forms and methods of pre-scientific, scientific and extra-scientific knowledge; modern approaches to socio-humanitarian and natural science knowledge and their commensurability.
	Can: formulate and solve problems arising in the course of research activities and requiring in-depth professional knowledge; choose the necessary research methods; analyze and comprehend the realities of modern theory and practice based on the methodology of socio-humanitarian and natural science knowledge.
	Owns: the skill to navigate in the theories of the historical development of scientific knowledge for the development of relevant research directions in the field of his own scientific interests of professional direction; the ability to modify existing methods and to develop new methods based on the problems of a specific scientific research.
LO 8	**Knows:** the main provisions of the content of higher education, modern didactic concepts in higher education, features of the design and organization of the pedagogical

	process at the university, modern educational technologies; fundamentals of pedagogical skills and pedagogical techniques, management in education, management of the process of formation and development of the personality of students.
	Can: formulate and solve problems arising in the pedagogical process and requiring in-depth pedagogical knowledge; analyze and comprehend the realities of modern theory and practice of higher education; diagnose and advise students taking into account the profile of future professional activity, the ability to abstract thinking, analysis and synthesis.
	Owns: the skills of conducting independent scientific and pedagogical activity; the skills of guiding the main provisions of normative documents in planning, forecasting, analysis of the main components of the learning and education process in higher education; the ability to apply methodological and methodical knowledge in conducting scientific research, educational and educational work.
LO 9	**Knows:** ways and means of increasing the work efficiency of the practical psychologist in the field of management organization; permissible boundaries and ways of influencing employees; procedure and patterns of meditative conflict resolution.
	Can: use knowledge in the field of theory and practice of organizing potential opportunities in the organizational sphere in managerial activities; applies the studied materials in the practical activities of a psychologist in the management sphere and in the field of resolving conflict situations between the subjects of interaction.
	Owns: skills of working with participants of the conflicting sides of the organizational system; skills of providing them with psychological assistance in the managerial sphere; willingness to communicate to solve problems in the field of management psychology; skills to take into account the interests, positions and motives of employees; skills for resolving professional conflicts in the organization.
LO 10	**Knows:** a foreign language to the extent necessary for obtaining professional information and communication; professional terminology; basic principles of working with scientific and technical literature of a professional orientation; basic rules for writing scientific and technical texts for working with reference materials, documents and periodicals on mechanics.
	Can: use a foreign language in interpersonal communication in professional activity; conduct written communication in a foreign language, compose business letters and scientific papers on mechanics; can to apply the acquired knowledge in his professional activity in the implementation of reading, translating scientific and technical literature on mechanics and and conducting written and oral professional communication.
	Owns: the skills of expressing one's thoughts and opinions in interpersonal and professional communication in a foreign language; skills of reading, translating and writing in a foreign language of special scientific and technical texts, reports and articles on mechanics; skills in applying the formulas of speech etiquette of communication in various formats: conferences, seminars, communication via the Internet, international cooperation.
LO 11	**Knows:** the variety of mechanisms by which the results of research work reach consumers; rights and obligations of the authors of the results of scientific and scientific and technical activities; the main provisions of the centers for the commercialization of the results of scientific and scientific and technical activities; rules for the development of high-tech innovative entrepreneurship in universities, research institutes and industrial enterprises.
	Can: commercialize the results of scientific and technical research; cooperate with organizations financing scientific developments with their subsequent implementation; improve the efficiency of commercialization and promotion of commercial use of the results of scientific, scientific and technical activities and their commercial turnover; strategically plan and manage science-intensive industries.
	Owns: the skills of creating organizations whose activities consist in the practical commercialization of the results of scientific and scientific-technical activities; the skills of obtaining intellectual property rights and the use of intellectual property objects; the skills of cooperation with organizations financing scientific developments with their subsequent implementation; the skills of researching design solutions in high-tech innovative entrepreneurship.
LO 12	**Knows:** basic theoretical positions and concepts, principles and methods of research, fundamental laws, relevant problems of the disciplines of mechanics; theoretical foundations of analytical, computational and experimental apparatus, basic tasks, leading l regularities and methods of mechanics for the study and solution of mechanical problems and problems of an applied nature.
	Can: effectively work with subject elements and objects of the disciplines of mechanics, demonstrating developing knowledge and understanding in the field under study; reveals the natural-scientific essence of mechanical problems arising in the course of professional activity, and attracts appropriate mechanical-mathematical theoretical and analytical apparatus for their research.
	Owns: a holistic and systematized set of generalized basic knowledge in fundamental mechanical, mathematical, natural science and technical disciplines necessary for forming judgments and conducting research activities on mechanical, natural science and experimental problems in the professional field.

Educational program graduate model

Competency types	Description of competencies
1. Behavioral skills and personal qualities (Softskills)	• Academic freedom • Knowledge of languages • Competent creativity • Ethical and aesthetic culture • Tolerance • Understanding the importance of the principles and culture of academic integrity
2. Digital competencies (Digital skills)	• Digital literacy • Algorithmic thinking and programming • Data analysis and artificial intelligence methods
3. Professional competencies (Hardskills)	• High professionalism in the field of theoretical and applied mechanics and mathematics

Developers:

Members of the working party:
The head of Algebra, Mathematical Logic and Geometry department named after Professor T.G. Mustafina — M.T. Kasymetova
The candidate of Physical and Mathematical Sciences, Associate Professor of Algebra, Mathematical Logic and Geometry department named after Professor T.G. Mustafina — G.A. Yessenbayeva
PhD, Associate Professor of Algebra, Mathematical Logic and geometry department named after prof.T.G.Mustafin — S.B. Akhazhanov
Master's degree student of the MMex-64 group of EP "7M05402 - Mechanics" — S.V. Skorobogatov
Head of the laboratory "Robotics and Intelligent Machines" — L.A. Zinoviev

The educational program was considered by the faculty council from 18.03.2022 Protocol No. 6/1
The educational program was considered at a meeting of the Academic Council from 28.04.2022 Protocol No. 5
The educational program was reviewed and approved at a meeting of the University Board dated 26.05.2022 Protocol No. 12

Member of the Board - Vice-Rector for Academic Affairs — T.Z. Zhusipbek

Director of the Department for Academic Affairs — G.S. Akybaeva

Dean of the Faculty of Mathematics and Information Technology — D.A. Kazimova

EDUCATIONAL PROGRAM DEVELOPMENT PLAN
«7M05402 - MECHANICS»

The purpose of the Plan is to contribute to improving the quality of the conditions for the implementation of the educational program, taking into account the current requirements of the labor market and the achievements of modern science.

Target indicators

№	Indicators	Unit of measurement	2022-2023 (in fact)	2023-2024 (plan)	2024-2025 (plan)	2025-2026 (plan)
1	**Human resources development**					
1.1	Increase in the number of teachers with academic degrees	Number of people	2	1	1	1
1.2	Advanced training in the teaching profile	Number of people	15		3	3
1.3	Involvement of practitioners in teaching	Number of people	2	1	1	1
2	**Promotion of the EP in the ratings**					
2.1	IQAA	Position	2	2	2	2
2.2	IAAR	Position	3	3	3	3
3.	**Development of educational and scientific-methodical literature, electronic resources**					
3.1	Textbooks	Number				1
3.2	Training manuals	Number	1	3	1	1
3.3	Methodological recommendations/instructions	Number		1		1
3.4	Electronic textbook	Number	5	2	1	1
3.5	Video/audio lectures	Number	5	1	1	1
3.6	Other (monographs)	Number		1		
4.	**Development of educational and laboratory facilities**	Number				
4.1	Purchase of software products	Number	1			
4.2	Purchase of equipment	Number				
5.	**Updating the content of the EP**					

5.1	Updating the learning outcomes and the list of disciplines taking into account the requirements of the labor market, scientific achievements, professional standards	Year	+			
5.2	Introduction to the EP of academic disciplines in foreign languages*	Year	+		+	
5.3	Introduction of new teaching methods	Year	+	+	+	+
5.4	Opening of joint/two-degree program on the basis of the EP	Year				

The head of Algebra, Mathematical Logic and Geometry department named after Professor T.G. Mustafina **M.T. Kassymetova**