MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE REPUBLIC OF KAZAKHSTAN
KARAGANDA BUKETOV UNIVERSITY

«AGREED »
Dean of the Faculty of Transport and Roads
"Karaganda Technical University
named after Abylkas Saginov"

_____ B.K. Kurmashev
«19» 04 2023.

«AGREED»
Director NIS of Chemistry and Biology
directions of Karaganda

_____ R.M.Yakupov
«21» 04 2023.

«APPROVED»
Chairman of the Board – Rector

_____ N.O. Dulatbekov
«03» 04 2023.

EDUCATIONAL PROGRAM

8D05401–«Mathematics»

Level: Doctoral PhD

Karaganda
2023

Educational program in the direction of preparation «8D05401- Mathematics " was developed on the basis of:

– Law of the Republic of Kazakhstan dated July 27, 2007 № 319-III «On Education" (with as amended and supplemented on 11.07.2017),

– Law of the Republic of Kazakhstan dated July 11, 1997 № 151-I. "On languages in the Republic of Kazakhstan" (with alterations and amendments as of 24.05.2018)

– State compulsory standard of postgraduate education from August 31, 2018 №604

– National Qualifications Framework by March 16, 2016 the Republican tripartite commission on social partnership and regulation of social and labor relations.

– **Order of the MES of RK "On Approval of Rules of organization of educational process on credit technology" dated October 2, 2018 №152 (as amended on 10.12.2018, № 563)**

– Classifier of training with higher and postgraduate education of 13 October 2018. №569.

– **State compulsory standard of primary education. Approved by the Government of the Republic of Kazakhstan from August 23, 2012 № 1080. Decision of the Republic of Kazakhstan dated August 15, 2017 № 484.**

- professional standards "teacher" (Appendix to the Order of the Chairman of the Board of the National Chamber of Entrepreneurs of Kazakhstan "Atameken" on June 8, 2017 № 133)

Recommended University Academic Council's decision to introduce with effect from 1 September 2021.

Content

Passport of the educational program «8D05401-Mathematics»

1. Code and name of the educational program: «8D05401-Mathematics»

2. Code and classification of the field of education, areas of studing: «8D05 Natural sciences, mathematics and statistics», «8D054 Mathematics and statistics»

3. Group of educational programs: D092 Mathematics and statistics

4. Amount of credit: 180 ECTS

5. Form of study: full-time

6. Language of study: English

7. Degree awarded: “Doctor of Philosophy (PhD)” in the educational program "8D05401-Mathematics".

8. Type of the EP: current

9. ISCE level (International Standard Classification of Education) – level 8

10. NQF level (National Qualifications Framework) – level 8

11. **SQF level** (Sectoral Qualifications Framework) – level 8.

12. Distinctive features of the EP: no

13. Application number to the license for the direction of personnel training: License KZ83LAA00018495, Appendix No. 012, date of issue 07/28/2020

14. Name of the accreditation body and the period of validity of accreditation of the EP: Certificate of specialized accreditation SA-A No. 0156/6 of NAOKO agency 05/27/2019 - 05/24/2024

15. Goal of the EP: The purpose of the educational program is to prepare, taking into account the prospects for the development of the country, competitive specialists of a new formation with fundamental knowledge, innovative approaches, research skills for the implementation of scientific, pedagogical, professional and practical activities in higher educational institutions, educational authorities, educational organizations, research centers. The conceptual foundations of national education at the doctoral level provide for broad basic professional training, which should be aimed at achieving the fundamental subject knowledge of future specialists. This should provide the doctor with a general integral methodology of professional activity, develop the ability of future specialists for professional creativity, and create a need for further improvement of the educational level.

16. Qualification characteristics of a graduate «8D05401- Mathematics».

a) List of graduate positions:

Graduates of the educational program can work as teachers, university professors, researchers.

b) Sphere and objects of professional activity of the graduate: The sphere of professional activity of graduates in the educational program "8D05401-Mathematics" are:

- higher education institutions,
- research institutes,

- design, technological and engineering organizations,
- bodies of the system of state administrative management.

The objects of professional activity of doctors in the educational program "8D05401-Mathematics" are:
- pedagogical process in universities,
- methodological and administrative work in educational institutions;
- research work in areas related to the use of mathematics.

c) Types of professional activity of a graduate:

Doctoral students of education in the educational program "8D05401-Mathematics" can perform the following types of professional activities:
- pedagogical (teaching in magistracy, doctoral studies);
- research;
- administrative and managerial (analyst, strategist in the field of science, education and high technologies);
- expert advisory (examination of scientific articles and projects, scientific supervision of master's theses, application of elements of innovation in the scientific and technical field).

d) Functions of the graduate's professional activity:

Doctoral students of education in the educational program "8D05401-Mathematics" can perform the following functions:
- teaching,
- educating,
- methodical,
- research,
- social and communicative.

17. Formulation of learning outcomes based on competencies

Graduate Attributes:

Deep professional knowledge in their field of study

- Interest in mastering trends in education and science
- Ability to collaborate in the professional community
- Independence in the search for opportunities for professional and personal development
- Sociability
- Tolerance and good manners
- Academic integrity
- Willingness to participate in solving state tasks and strategies of Kazakhstan

Type of competencies	Code of learning results	Learning results (on Bloom's taxonomy)
Behavioral skills and personal qualities (Softskills)	LO 1	Communicates on professional topics in the scientific community, writes scientific articles in English, translates scientific literature from English, interprets scientific achievements in the field of natural sciences.
	LO 2	Plans and builds comprehensive research within the framework of the dissertation work, including interdisciplinary, based on a holistic systematic scientific worldview, illustrates and applies critical analysis, evaluates modern scientific achievements, offers options and evaluates new ideas in solving research and practical problems, including in interdisciplinary fields
Professional competencies (Hardskills)	LO 3	Illustrates the main problems of fundamental areas of mathematical science and freely analyzes, solves issues related to the following sections and concepts: theory of functions and functional spaces, including generalized functions, Sobolev spaces and embedding theorems, boundary value problems for differential equations, non-commutative analysis of operators, random functions, stochastic integrals and stochastic differential equations. Groupoids and groups. Quasigroups and loops.
	LO 4	Synthesizes research and pedagogical experience, forming a rational method of presenting information on complex structural theories of integral transformations, group theories, applications of functional analysis and theories of loaded equations. Applies the acquired skills of processing the results of research work, and in the future presents and reports the results of scientific research on the topic of a doctoral dissertation.
	LO 5	Uses the following theoretical material to solve applied problems: integral transformations in the complex domain, finite integral transformations, initial-boundary value problems of thermal conductivity, Weierstrass, Hankel, Mellin transformations. Classifies and solves problems of an applied nature of mathematical tools: dynamic problems; hydrodynamic problems; two-dimensional problems of elasticity theory. Defines and computes problems related to various classes of integral transformations, including classical integral transformations (Fourier, Hankel, Mellin, etc.), finite integral transformations, biorthogonal integral transformations.
	LO 6	Studies and arranges, and later applies Galois theory, Galois extensions, Galois groups and their properties, ordered fields, as well as Morley rank, countable models of -1-categorical theories, and other theoretical materials related to model theory.

18. Definition of modules of disciplines in accordance with learning results

Code of learning results	Module name	Name of disciplines	Volume (ECTS)
LO 1, LO2	Methodological basics of research	Academic writing	5
		Methods of scientific research	5
LO 3, LO 4	Actual problems of modern mathematics	Actual problems of fundamental directions of mathematics	5
		Teaching practice	10
		Research practice	10
LO 4, LO 5, LO 6	Fundamental mathematics	Operational calculus Integral transformations and their applications	5
		Select questions of algebra (in English language) Select questions of theory of models (in English language)	5
LO 1, LO 2, LO 3, LO 4, LO 5, LO 6	Research work by a doctoral candidate	Research work of a doctoral candidate, including an internship and a doctoral thesis	123
	Final assessment	Writing and defense a doctoral thesis	12

19. Achievability Matrix of Learning Results

N	Name of disciplines	Brief description of the discipline	Credit quantity	Formed learning results (codes)					
				LO 1	LO 2	LO 3	LO 4	LO 5	LO 6
Cycle of basic disciplines University component									
D1	Academic writing	The discipline is studied in order to form competencies related to analytical research and textual activities; skills of analytical-synthetic, critical and pragmatic thinking. In the process of studying the discipline, the types, methods and ethical principles of writing scientific texts, the principles of constructing a scientific text and preparing it for publication, the design of a bibliographic list, the basic rules for quoting scientific literature, the types of annotations and the features of their compilation, reviewing a scientific text are considered.	5	+					
D2	Methods of scientific research	The discipline is studied in order to form the skills of doctoral students to carry out independent research activities; the use of scientific research methods to achieve the objectives set in the dissertation research; the use of methods of processing empirical data on the topic of their dissertation research.	5		+	+			
D3	Teaching practice	The goal of teaching practice is to develop professional competencies among doctoral students that ensure readiness for teaching at universities, designing the educational process in accordance with the training profile and conducting certain types of training sessions using innovative educational technologies.	10				+		
Cycle of basic disciplines Selectable Component									
D4	Integral transformations and their applications Operational calculus	Presentation of the basic concepts of the theory of Hilbert spaces, the mathematical apparatus that necessary for substantiating the methods of integral transformations, demonstrating the procedures for constructing and substantiating solutions to initial – boundary problems by operational methods and methods of integral transformations; study of various classes of integral transformations, including classical integral (Fourier, Hankel, Mellin, etc.), finite integral, biorthogonal transformations. The basic facts and methods of operational calculus and possible areas of their applications related to fundamental and applied mathematics are presented. Mastering the course will allow you to understand, improve and apply the modern mathematical apparatus of operational calculus to solve problems of a computational and theoretical nature.	5						
Profiling disciplines University component									

D5	Research practice	The research practice of doctoral students of the scientific direction is carried out at the place of execution of the dissertation in order to familiarize themselves with the latest theoretical, methodological and technological achievements of domestic and foreign science, with modern methods of scientific research, processing and interpretation of experimental data in the dissertation research. The content of the research practice is determined by the topic of the doctoral student's dissertation research.	10				+		
D6	Actual problems of fundamental directions of mathematics	The course covers the following sections: theory of functions and functional spaces, including Generalized functions, Sobolev Spaces and Embedding Theorems, boundary value problems for differential equations, noncommutative analysis of operators, random functions, stochastic integrals, and stochastic differential equations. Groupoids and groups. Quasigroups and loops. Groups. Rings. Algebraically closed fields. Linear Algebras. Lattices. Modular and distribution lattices. Bullean algebras.	5				+		+
Profiling disciplines Selectable Component									
D7	Selected questions of model theory (in English) Selected questions of algebra (in English language)	$\aleph_1$-categorical theories. ω-stable theories. Saturated models and the monster. Morley rank. Countable models of $\aleph_1$-categorical theories. Simple theories.Dividing and forking. Simplicity. The independence theorem. Stable theories. Heirs and coheirs. Definable types. Elimination of imaginaries and T^{eq}. Prime extensions. Totally transcendental theories. Countable stable theories. Algebraic Number Fields. Finite and algebraic extensions. Algebraic closure. Finite fields. Simple algebraic extensions. Splitting fields and normal extensions. Factorization of Quadratic Integers. Galois Theory. Galois extensions. The Galois Group and its properties. Ordered fields. Real fields. Real zeros and homomorphisms. Subgroups and Subfields.	5				+		+
Research work of a doctoral candidate									
D8	Research work of a doctoral candidate, including an internship and a doctoral thesis	The purpose of the research work of a doctoral candidate is to form the level of knowledge, skills and abilities of research activities necessary for the implementation of professional activities and to prepare for the defense of a doctoral thesis	123	+	+	+	+	+	+

20. Aligning planned learning outcomes with teaching and assessment methods within the module

Learning Results	Planned learning results for the module	Teaching methods	Assessment methods
LO 1	Communicates on professional topics in the scientific community, writes scientific articles in English, translates scientific literature from English, interprets scientific achievements in the field of natural sciences.	Dialog Round table Interactive lecture Project based learning Oral presentation	Test control Oral questioning Abstract preparation Essay writing
LO 2	Plans and builds comprehensive research within the framework of the dissertation work, including interdisciplinary, based on a holistic systematic scientific worldview, illustrates and applies critical analysis, evaluates modern scientific achievements, offers options and evaluates new ideas in solving research and practical problems, including in interdisciplinary fields	Discussion Round table Interactive lecture Oral presentation	Testing Oral questioning Abstract preparation Essay writing
LO 3	Illustrates the main problems of fundamental areas of mathematical science and freely analyzes, solves issues related to the following sections and concepts: theory of functions and functional spaces, including generalized functions, Sobolev spaces and embedding theorems, boundary value problems for differential equations, noncommutative analysis of operators, random functions, stochastic integrals and stochastic differential equations. Groupoids and groups. Quasigroups and loops.	Lecture Practice Analysis and problem solving Exercises	Test control Written control Colloquium Express survey
LO 4	Synthesizes research and pedagogical experience, forming a rational method of presenting information on complex structural theories of integral transformations, group theories, applications of functional analysis and theories of loaded equations. Applies the acquired skills of processing the results of research work, and in the future presents and reports the results of scientific research on the topic of a doctoral dissertation.	Interactive lecture Practical work Analysis and problem solving Exercises	Test control Written control Colloquium Settlement task
LO 5	Uses the following theoretical material to solve applied problems: integral transformations in the complex domain, finite integral transformations, initial-boundary value problems of thermal conductivity, Weierstrass, Hankel, Mellin transformations. Classifies and solves problems of an applied nature of mathematical tools: dynamic problems; hydrodynamic problems; two-dimensional problems of elasticity theory. Defines and computes problems related to various classes of integral transformations, including classical integral transformations (Fourier, Hankel, Mellin, etc.), finite integral transformations, biorthogonal integral transformations.	Interactive lecture Practical work Analysis and problem solving Exercises	Test control Written control Colloquium Settlement and graphic task
LO 6	Studies and arranges, and later applies Galois theory, Galois extensions, Galois groups and their properties, ordered fields, as well as Morley rank, countable models of -1-categorical theories, and other theoretical materials related to model theory.	Interactive lecture Practical work Analysis and problem solving Exercises	Test control Written control Colloquium

21. Criteria for assessing the achievability of learning outcomes

LO codes	Criteria
LO 1	**Knows:**methods, technologies and norms of scientific communication, features of presenting the results of scientific activity in oral and written form when working in domestic and international research teams.
	Can:applymethods and technologies of scientific communication, features of presenting the results of scientific activity in oral and written form when working in domestic and international research teams.
	Owned by: the basic norms adopted in scientific communication; norms adopted in scientific communication when working in domestic and international research teams in order to solve scientific and scientific and educational problems.
LO 2	**Knows:**planning technologies in professional activities in the field of scientific research, technologies for evaluating the results of collective activities
	Can:to distinguish between the use of planning technologies in professional activities in the field of scientific research
	Owned by:critical analysis, new ideas in solving research and practical problems, including in interdisciplinary areas
LO 3	**Knows:**main problems of fundamental areas of mathematical science, function theory and function spaces, including generalized functions, Sobolev spaces and embedding theorems, boundary value problems for differential equations, non-commutative analysis of operators, random functions, stochastic integrals and stochastic differential equations. Groupoids and groups. Quasigroups and loops. Groups. Rings. Algebraically closed fields. Linear algebras. Lattices. Modular and distributive lattices. Boole algebras. Filters and ultrafilters.
	Can:classify and analyzemain problems of fundamental areas of mathematical science
	Owned by:basic methods that solve most of the fundamental problems of universal algebra and functional analysis
LO 4	**Knows:**positions and categories of science for the analysis and evaluation of various facts and phenomena, modern research tools in the field of professional activity, alternative options for solving research and practical problems
	Can:analyze the provisions and categories of science for the analysis and evaluation of various facts and phenomena, use modern research tools in the field of professional activity. Explain the structurally complex theoretical material related to the area of science under study, review the problem areas of mathematical science. Apply the acquired skills of formalizing the results of research work, and in the future present and report the results of scientific research on the topic of a doctoral dissertation.
	Owned by:theoretical material related to the area of science under study and problem areas of mathematical science.
LO 5	**Knows:**inversion formula for the Mellin transform; Inversion formula for the Hankel transform; Dual integral equations; Tikhonov's uniqueness theorem; Weierstrass-Stieltjes transformation of non-decreasing functions; Mittag-Leffler transformation. Poperatic string vibrations,forced oscillations of a cylinder and a sphere, irrotational motion of an ideal fluid, slow motion of a viscous fluid, motion of a fluid under the action of a surface load, a plane problem of elasticity theory for an infinite strip, a plane problem of elasticity theory for a circular dimple. Basic concepts of the theory of Hilbert spaces, the technique of operational calculus and algorithmic procedures of methods of integral transformations.
	Can:use various methods of integral transformations to solve the tasks, analyze applied problems and choose the best solution method, obtain solutions to linear initial-boundary problems of continuum mechanics in the form of spectral expansions (integrals and series).
	Owned by:tools of integral transformations for solving differential problems of various types, methods of integral transformations for solving applied problems, special classes of integral transformations (finite integral transformations, biorthogonal transformations).
LO 6	**Knows:**Galois theory, Galois extensions, Galois groups and their properties, ordered fields, as well as Morley rank, countable models of ℵ1-categorical theories, and other theoretical materials related to model theory.
	Knows:methods, technologies and norms of scientific communication, features of presenting the results of scientific activity in oral and written form when working in domestic and international research teams.
	Can:applymethods and technologies of scientific communication, features of presenting the results of scientific activity in oral and written form when working in domestic and international research teams.

22. Graduate Model: educational program "8D05401-Mathematics"

Graduate Attributes:

• High professionalism in the field of mathematics
• Emotional intellect
• Adaptability to global challenges
• Leadership
• Entrepreneurial mindset
• Global citizenship
• Understanding the importance of the principles and culture of academic integrity

Types of competencies	Description of competencies
Behavioral skills and personal qualities (Softskills)	ability to follow ethical standards in professional activities the ability to plan and solve problems of one's own professional and personal development willingness to use modern methods and technologies of scientific communication in the state and foreign languages
Professional competencies: (Hardskills)	Ability to design and carry out complex researches, including interdisciplinary, on the basis of integral system scientific outlook with use of knowledge in the field of the analysis and differential equations Ability to design and carry out complex research, including interdisciplinary, on the basis of a holistic system of scientific worldview using knowledge in the field of algebra, geometry and logic ability to independently carry out research activities in the field of integrated transformations and their applications using modern research methods and information and communication technologies ability to independently carry out research activities in the field of model theory using modern research methods and information and communication technologies ability to independently carry out research activities in the field of the theory of boundary value problems for differential equations of hyperbolic type using modern research methods and information and communication technologies ability to independently carry out research ability to independently carry out research activities in the field of the theory of absolute summability of series using modern research methods and information and communication technologies ability to critically analyze and evaluate modern scientific achievements, generate new ideas in solving research and practical problems, including in interdisciplinary areas willingness to participate in the work of domestic and international research teams to solve scientific and educational problems readiness for teaching on the main educational programs of higher education

Originators:

Working group members:	
Head of the department Mathematical analysis and differential equations	A.O. Tanin
Candidate of Pedagogical Sciences, Professor of the Department of Mathematical Analysis and Differential Equations	B.K.Shayakhmetova
Employer	R.M.Yakupov
Third year doctoral student	T.D.Tokmagambetova
The educational program was considered by the faculty council from	25.04.2023 protocol № 7
The educational program was considered at a meeting of the Academic Council from	28.04.2023 protocol № 5
The educational program was reviewed and approved at a meeting of the University Board from	30.05.2023 protocol № 12
Member of the Board - Vice-Rector for Academic Affairs	T.Z.Zhusipbek
Director of the Department of Academic Affairs	S.A. Smailova
Dean of the Faculty	D.A. Kazimova