Geology and oil-gas Business Institute named after k. Turyssov
Department of " Geophysics and Seismology"

EDUCATIONAL PROGRAM
8D05302 Seismology

Code and classification of the field of education: **8D05 «Natural Sciences, Mathematics and Statistics»**
Code and classification of training areas: **8D053 «Physical and chemical sciences»**
Group of educational programs: **D091 «Seismology»**
The level of the NQF: 8
The level of the IQF: 8
Duration of training: 3 years
Volume of credits: 180

Almaty 2024

The educational program 8D05302 – "Seismology" was approved at the meeting of NJSC "Kazakh National Research Technical University named after K.I.Satpayev" Academic Council.

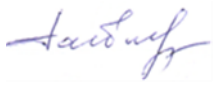
Protocol №12 of April 22, 2024.

Was Reviewed and recommended for approval at the meeting of NJSC "Kazakh National Research Technical University named after K.I.Satpayev" Educational and Methodological Council

Protocol № 6 of April 19, 2024.

The educational program 8D05302 – «Seismology» developed by the academic committee in the direction of 8D053 «Physical and Chemical Sciences»

Full name	**Academic degree/ academic title**	**Position**	**Workplace**	**Signature**
Teaching staff:				
Ratov Boranbay Tovbasarovich	Doctor of Technical Sciences	Head of the Department of " Geophysics and Seismology"	NJSC "Kazakh National Research Technical University named after K.I.Satpayev"	
Abetov Auez Egemberdyevich	Doctor of Geological and Mineralogical Sciences,	Professor	NJSC "Kazakh National Research Technical University named after K.I.Satpayev"	
Umirova Gulzada Kubashevna	Doctor of PhD	Associate Professor	NJSC "Kazakh National Research Technical University named after K.I.Satpayev"	
Temirkhanova Raushan Galimzhanovna	Doctor of PhD	**Associate Professor**	NJSC "Kazakh National Research Technical University named after K.I.Satpayev"	
Isagalieva Aigul Kalievna	Doctor of PhD	Senior Teacher	NJSC "Kazakh National Research Technical University named after K.I.Satpayev"	
Aliakbar Madiyar Manarbekuly	Master of Technical Sciences	Senior Teacher	NJSC "Kazakh National Research Technical University named after K.I.Satpayev"	

Employers:				
Mikhailova Natalia Nikolaevna	Doctor of Physical and Mathematical Sciences	Director	Kazakhstan National Data Center (KNDC)	
Uzbeks Nursarsen Bolataevich	Candidate of Physical and Mathematical Sciences	Deputy Director of Science	Institute of Seismology	
Students				
Dosymbekova Zhansaya	Master of Technical Sciences	Doctoral student 2 years of study	Institute of Seismology	
Isagali Asem	Master of Technical Sciences	Doctoral student 2 years of study	Kazakhstan National Data Center (KNDC)	
Muzapparova Akerke Bakbergenovna	Master of Technical Sciences	Doctoral student 1 years of study	NJSC "Kazakh National Research Technical University named after K.I.Satpayev"	

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List of abbreviations and designations

B – basic knowledge, skills and abilities;
HEI – higher education institution;
State – state mandatory standards of education;
ICT – information and communication technologies;
NJSC «KazNRTU named after K.I.Satpayev»– Non-profit joint stock company «Kazakh national research technical university named after K.I. Satbayev»;
NQF – National Qualifications Framework;
IQF – Industry Qualifications Framework;
O – universal, social and ethical competencies;
PC – professional competencies;
RO – learning outcomes of the educational program;
C – special and managerial competencies;
SIS- student independent study;
EP-educational program;
BD- basic discipline;
PD- profile discipline;
UC- University component;
CC-Component of choice;
FA- final assessment;
RWDS - Research work of a doctoral student.

1. Description of the educational program

Doctoral studies in the educational program - 8D05302 “Seismology” stimulates the formation of professional competencies necessary to solve complex seismogeophysical problems that require the use of in-depth fundamental knowledge; abstract thinking and originality of analysis; go beyond the issues covered by standards and practice; develop non-standard solutions in problem situations; adapt to new situations, reassess accumulated experience, create new knowledge based on seismogeophysical studies; setting innovative professional tasks in the field of research and practice; finding optimal solutions to professional tasks, taking into account their validity, cost, information, social and economic security; solving managerial tasks in the conditions of real-life production structures.

The PhD preparation program for the educational program - 8D05302 “Seismology” provides:

a) training of highly qualified specialists in the field of seismogeophysical methods for assessing seismic hazard, risk and earthquake forecasting; obtaining high-quality and professional knowledge on forecasting the places of occurrence, strength and recurrence of earthquakes;

b) formation of knowledge in the required volume for studying earthquake foci, displacements of Earth blocks along faults and other environmental transformations in foci, conducting detailed studies of earthquake preparation processes in a real physical and geological environment, performing assessments of the parameters of the focus, identifying earthquake precursors and developing long-term, medium-term and short-term earthquake forecasts, ways to control the seismic process, assessment of anthropogenic (technogenic) influence on seismicity.

c) a qualified solution of engineering and seismological problems, which consists in studying the seismic wave field caused by an earthquake near the hearth, studying strong seismic movements of the earth's surface and the interaction of soil with the structure, developing methods and conducting seismic micro-zoning, determining the impact of earthquakes on the hydrosphere and the Earth's atmosphere;

d) obtaining high-quality and professional knowledge by doctoral students on the stages and rational complexes of seismogeophysical research, processing, interpretation and modeling of the data obtained.

Doctoral studies in the educational program - 8D05302 “Seismology” includes training in working in modern computer programs for processing seismological data.

Professors from leading universities near and far abroad, leading experts from manufacturing companies and research institutes are invited to conduct lectures and consultations on modern problems of seismology and geophysics.

Field of professional activity:

The area of professional activity of graduates who have completed the doctoral program in the educational program - 8D05302 "Seismology", includes solving problems that require the application of fundamental and applied knowledge

in the Earth sciences within the framework of the main areas of scientific research and includes the study:

a) the structure and material composition of the Earth's lithosphere,

b) the seismic process, which has connections with physical geography, geology, tectonics, especially with neotectonics and seismotectonics, with the mathematical theory of random processes and cosmophysics.

The study of the earthquake source and precursors is based on the achievements of solid state physics, geomechanics, especially the theory of brittle fracture of materials, geodesy, various sections of Earth physics, hydrogeology, geochemistry.

The problem of earthquake prediction is close to the problem of predicting mountain impacts, which are studied by mining sciences. Studies near the earthquake focus take into account the achievements of engineering geology and are necessary for the development of earthquake-resistant construction.

The use of seismic waves to study the internal structure of the Earth requires the use of methods of mathematical physics and combination with data from gravimetry, geothermy, petrology, geomagnetism and other Earth sciences.

Objects of professional activity:

The objects of professional activity of doctoral graduates in the educational program - 8D05302 “Seismology” are the lithosphere and tectonosphere of the Earth, their composition, structure, evolution; rocks; geophysical fields; natural and man-made geological and hydrogeochemical processes, physico-geological models of layers of the Earth's lithosphere; earthquake foci, their monitoring and forecast; computerized and software-controlled information-measuring and processing systems and complexes.

Types of professional activity:

In accordance with the fundamental and professional training received, doctors in the educational program 8D05302 "Seismology" can perform the following types of activities:

a) organizational and managerial activities:

- планирование, организация и управление научно-исследовательскими и научно-industrial field, laboratory and interpretive seismogeophysical works;
- development of operational work plans for seismological parties and detachments;
- selection and justification of scientific, technical and organizational solutions based on seismogeophysical data and economic calculations.

b) research activities:

- independent selection and justification of the goals and objectives of scientific seismological and geological-geophysical research;
- mastering the methods of solving the tasks set during monitoring, interpretation studies using modern seismogeophysical equipment, instruments and information technologies;

- analysis and generalization of the results of research works using modern achievements of science and technology, advanced domestic and foreign experience in the field of seismology;

- preparation of scientific reports, publications, reports, preparation of applications for inventions and discoveries.

- planning and organization of scientific and production seminars and conferences.

c) scientific and production activities:

- independent preparation and conduct of research, monitoring and interpretation studies in solving practical problems in the field of seismology;

- independent selection, preparation and professional operation of modern seismogeophysical equipment and instruments;

- collection, analysis and systematization of available seismological and geological information using modern information technologies;

- complex processing, interpretation and modeling of seismic and geophysical information in order to solve research and practical problems in the field of seismology;

- participation in the development of normative methodological documents in the field of seismic and geophysical research.

d) project activities:

- design and implementation of scientific and technical projects in the field of seismology;

- participation in the examination of projects of scientific research seismological works.

e) scientific and pedagogical activity:

- participation in the preparation and conduct of seminars, laboratory and practical classes;

- participation in the management of research work of students in the field of seismology.

Areas of professional activity:

In the profile direction are:

-organizational and technological; settlement and design; service and operational; production and technological activities in:

- academic and departmental research organizations related to the solution of seismogeophysical problems;

- in akimats of regions, cities, in the Ministry of Emergency Situations and departments of Emergency Situations and emergency Situations;

- in organizations related to environmental monitoring and solving environmental problems.

At the scientific and pedagogical direction:

- organizational and managerial; research; educational (pedagogical) activities of various directions in higher, secondary specialized and vocational educational institutions.

- scientific activity in information services, research institutions, government agencies, educational institutions, design organizations, industrial enterprises.

2. The purpose and objectives of the educational program

EP purpose:

The goal of the Educational Program (EP) is to achieve a high level of knowledge and understanding formed by doctoral students on the basis of systematic study of Geophysics and special education about natural seismic processes on Earth and the formation of a highly qualified specialist who is able to independently solve educational, research and professional tasks.

EP tasks:

- formation of universal, general professional and professional competencies for doctoral students, defined by the profile "Seismology", which will allow them to navigate modern scientific concepts, competently set and solve research and practical tasks, participate in practical activities, master the basic methods of teaching and upbringing and a set of knowledge, teaching methods in higher educational institutions;
- improvement of natural science education, including those focused on professional activity in seismology;
- improving the skills and abilities of using modern information and communication technologies in research and teaching activities;
- improvement of knowledge of a foreign language, including for use in professional activities.

With the profile direction:

- acquisition and consolidation of knowledge about the fundamental laws of radiation and propagation of seismic waves in the lithosphere, theories and methods of studying its internal structure using seismic waves, modern ideas about the nature and patterns of seismicity and seismic regime of various areas, modern models of earthquake focus physics and their preparation processes, principles and methods of seismic hazard assessment, seismic zoning and earthquake prediction;
- acquisition of the ability to plan experiments to study the deep structure of the Earth by seismogeophysical methods, conduct instrumental seismic and geophical observations, process and interpret the data obtained, determine the parameters of earthquake foci from seismic records and macroseismic manifestations, plan and carry out work on general, detailed and microseismic zoning, draw conclusions about the seismic hazard of specific territories and objects.
- formation of skills of independent research activity and the ability to expand and deepen knowledge in seismology, including the development of new theories and models, mathematical modeling of seismicity processes, etc.;
- acquisition of skills in organizing and conducting seismological research necessary to carry out scientific work in doctoral studies.

At the pedagogical direction:

- providing high-quality education in accordance with state educational standards;
- training of competitive specialists with a high level of professional culture, in demand in the labor market and possessing a set of necessary knowledge and

skills, able to formulate and solve modern scientific and practical problems of seismology, teach at universities, successfully carry out research and management activities;

- obtaining knowledge in the field of university pedagogy and psychology, teaching experience at the university;
- development and introduction into practice of effective mechanisms for the integration of higher education with science;
- development of science, technology and technologies through scientific research and creative activity of scientific and pedagogical personnel and students.

3. Requirements for evaluating the learning outcomes of an educational program

As a result of mastering the doctoral program, the graduate should have general cultural, general professional and professional competencies.

A graduate of a specialized doctoral program should: have an idea about current trends in the development of the seismological industry; about current methodological and philosophical problems of seismology; about the current state of the economic, political, legal, cultural and technological environment of the global business partnership.

A graduate of the EP "Seismology" must have the ability to:

- abstract thinking, analysis, synthesis of a seismogeophysical database; act in non-standard situations, bear social and ethical responsibility for decisions made, show a desire for self-development, self-realization, and the use of creative potential;
- independently acquire, comprehend, structure and use new knowledge and skills in professional activity, develop their innovative abilities; be able to independently formulate research goals and establish the sequence of solving professional tasks; apply in practice knowledge of fundamental and applied sections of disciplines that determine the focus (profile) of the doctoral program;
- possess professional competencies (PC) corresponding to the type of professional activity that the doctoral program is focused on;

Graduates of the doctoral program should have in-depth systematic knowledge in the field of seismogeophysical methods. They should be able to:

a) to form diagnostic solutions to seismological problems by integrating fundamental sections of seismological sciences and specialized knowledge;

b) be able to independently conduct scientific and methodological work and research in seismology;

c) summarize and analyze experimental information;

d) draw conclusions, formulate conclusions and recommendations.

A graduate of the OP "Seismology" must:

- be able to use effective methods of processing and interpreting complex information to solve tasks; create and explore models of the studied objects based on the use of in-depth theoretical and practical knowledge;

- be able to critically analyze, present, defend, discuss and disseminate the results of their professional activities;

- possess the skills of drawing up and processing scientific and technical documentation, scientific reports, reviews, reports and articles;

- be competent in the search and interpretation of technical information using various search engines (patent search, literary review of magazines and books, Internet), in the selection and creative use of modern equipment for solving scientific and practical problems of seismology;

- be socially mobile, be able to adapt to new situations in the professional environment, have the ability to perceive diversity and intercultural difference, appreciate diverse approaches to understanding and solving problems of society;

- be able to organize cooperation in a team, show creativity and breadth of interests to solve interdisciplinary problems;

- be tolerant of social, ethnic, confessional and cultural differences, be capable of criticism and self-criticism, have skills of interaction and cooperation, be ready to accept the role of a team leader, appreciate the traditions of other cultures, their diversity in modern society, fundamental basic education, economic, social and legal training;

- maintain the rules of ethics in society, at work and in interpersonal communication, demonstrate the ability to achieve goals, solve problems in non-standard situations.

- to take care of environmental protection and, by improving skills, to serve the development of the welfare of the whole society.

4. Passport of the educational program

4.1. General information

№	Field name	Comments
1	Code and classification of the field of education	8D05 Natural sciences, mathematics and statistics
2	Code and classification of training directions	8D053 Physical and chemical sciences
3	Educational program group	D091 Seismology
4	Educational program name	8D05302 Seismology
5	Short description of educational program	The doctoral training program for the EP "Seismology" provides: a) training of highly qualified specialists in the field of seismogeophysical methods for assessing seismic hazard, risk and earthquake forecasting; obtaining high-quality and professional knowledge on forecasting the places of occurrence, strength and recurrence of earthquakes; b) formation of knowledge to the required extent for studying earthquake foci, displacements of Earth blocks and other environmental transformations in foci, conducting detailed studies of earthquake preparation processes in a real physico-geological environment, performing assessments of the parameters of the focus, identifying earthquake precursors and developing long-term, medium-term and short-term earthquake forecasts, methods of controlling the seismic process, assessment of

		anthropogenic (man-made) influence on seismicity; c) a qualified solution of engineering and seismological problems, which consists in studying the seismic wave field caused by an earthquake near the hearth, studying strong seismic movements of the Earth's surface and the interaction of soil with the structure, developing methods and conducting seismic microdistricting, determining the impact of earthquakes on the hydrosphere and the Earth's atmosphere; d) obtaining high-quality and professional knowledge by phasing and rational complexes of seismogeophysical studies, processing, interpretation and modeling of the obtained data.
6	EP purpose	The goal of the Educational Program (EP) is to achieve a high level of knowledge and understanding formed by doctoral students on the basis of systematic study of Geophysics and special education about natural seismic processes on Earth and the formation of a highly qualified specialist who is able to independently solve educational, research and professional tasks.
7	Type of EP	New EP
8	The level of the NQF	8
9	The level of the IQF	8
10	Distinctive features of the EP	no
11	List of competencies of the educational program	**General cultural competencies (GC):** GC1 – ability to communicate orally and in writing in the state, Russian and foreign languages to solve problems of interpersonal and intercultural interaction; GC2 – understanding and practical use of healthy lifestyle norms, including prevention issues, the ability to use physical culture to optimize performance; GC3 – the ability to analyze the main stages and patterns of the historical development of society for the formation of a civic position; GC4 – the ability to use the basics of philosophical knowledge to form a worldview position; GC5 – the ability to critically use the methods of modern science in practice; GC6 – awareness of the need and acquisition of the ability to independently study and improve their qualifications throughout their work; GC7 – meaning and understanding of professional ethical standards, mastery of professional communication techniques; GC8 – the ability to work in a team, tolerantly perceiving social, ethical, confessional and cultural differences; GC9 – the ability to use the basics of economic knowledge in various fields of activity. **General professional competencies (GPC):** GPC 1 – the ability to independently acquire, comprehend, structure and use new knowledge and skills in professional activities, develop their innovative abilities; GPC 2 – the ability to put into practice the knowledge of fundamental and applied sections of seismogeophysical disciplines that determine the orientation (profile) of the doctoral program in seismology;

		GPC 3 – the ability to independently design and carry out research activities in the field of seismology based on the use of modern research methods and information and communication technologies with the use of complex seismological and interdisciplinary research; GPC 4 – understanding of the essence and significance of the interrelation of theoretical and practical research in seismology, allowing to study the processes and mechanisms of seismicity efficiently and rationally; to reduce the risks of man-made impacts on industrial and civil facilities. **Professional Competencies (PC):** PC 1 – knowledge of promising areas of development and problems of seismology, the current level of elaboration of problems. The ability to participate in work on innovative projects, set specific seismological tasks and solve them based on the use of modern equipment, software and information technologies using the latest domestic and foreign experience; PC 2 – the ability to form diagnostic solutions to professional problems of seismology by integrating fundamental and applied sections of geophysics (gravity-magnetic exploration, geoelectrics, seismology and seismic exploration) and specialized geological and geophysical knowledge (about physical processes occurring in the Earth and the internal structure of the Earth) for the analysis of seismological data and solving problems of seismology; PC 3 – the ability of general technical and administrative management and ensuring timely collection of materials for conducting seismological observations. General technical and administrative management and ensuring timely execution of work on the preparation of seismological equipment and observation systems for stationary and field seismological observations; PC 4 – ability to general technical and administrative management, planning and ensuring timely registration of seismic records at stationary and expeditionary seismic stations; PC 5 – the ability to organize, general technical and administrative management of digital processing and transformation of primary data into a form that provides analysis and effective interpretation; PC 6 – the ability to compile a database of seismological data of the research area for the development of an earthquake catalog, operational catalogs and earthquake bulletins. Analysis of seismograms, properties of seismic waves (attenuation) in seismological monitoring. Analysis and modeling of strong motion processes for the development of a consolidated earthquake catalog; PC 7 – skills for developing conclusions on the level of seismic activity and the main morphological and kinematic characteristics of the identified seismogenerating structures. Preparation of complex data for the construction of a seismotectonic map, maps of seismic impacts and seismic zoning. Creating a digital archive of reporting data;

		PC 8 – the ability to coordinate and guide the interaction of structural units in the preparation of accounting documentation; PC 9 – the ability to identify and systematize the main ideas in scientific publications; critically evaluate the effectiveness of various approaches to solving seismological problems; formulate an independent view of the proposed problem taking into account the latest domestic and foreign experience.
12	Learning outcomes of the educational program:	LO 1: Demonstrate advanced knowledge formed on the basis of a systematic study of fundamental and applied geophysics about natural seismic processes occurring in the Earth; LO 2: Understand and professionally solve the problems of seismology by synthesizing and integrating sections of geophysics, specialized geological and structural-tectonic knowledge for system analysis, interpretation, explanation and generalization; LO 3: Apply knowledge and understanding in planning, designing, implementing and analyzing an integrated process of scientific seismological research based on in-depth competencies to solve seismological problems; LO 4: Conduct seismological field measurements, visualize the results based on comparison with complex data and develop conclusions, scientific conclusions to identify the features of the work results; LO 5: Synthesize original ideas, research results in scientific publications of a national or international level in order to expand the boundaries of the scientific field and make a significant scientific contribution to the seismological industry; LO 6: Use your own assessment of the latest domestic or foreign experience in the formation of an original judgment of a professional problem and the conduct of ethical written and oral communication.
13	Form of training	full - time
14	Duration of training	3
15	Volume of loans	180
16	Languages of instruction	Russian/ Kazakh
17	Academic degree awarded	Doctor of Philosophy PhD
18	Developer(s) and authors:	1). Professor Abetov A.E., 2). Associate Professor Umirova G.K.

4.2. The relationship between the achievability of the formed learning outcomes and academic disciplines according to the educational program

№	Name of the discipline	Brief description of the discipline	Number of credits	Generated learning outcomes (codes)					
				LO 1	LO 2	LO 3	LO 4	LO 5	LO 6
Cycle of basic disciplines University component									
1	Research methods	It is a theoretical basis for passing research practice, performing research work and writing a doctoral dissertation. Provides preparation for independent research work and educational activities. The concepts of scientific research methods, their theoretical and empirical components, the development of research methodology, and the classification of methods of scientific knowledge are considered. Theoretical (induction, deduction, axiomatic method, analysis) and empirical (observation, comparison, experiment, measurement, abstraction) methods of scientific research, their relationship and addition are studied.	5	✓		✓	✓	✓	✓
2	Academic writing	The purpose of the discipline is to form skills and competencies for expressing the results of scientific research in the form of a clear, scientific text confirmed by arguments. The learning outcomes will help in working with information in various scientometric databases, in creating your own original view of a particular solution of scientific research, in summarizing scientific articles related to the direction of study.	5					✓	✓
3	Pedagogical practice	Pedagogical practice is an obligatory component that consolidates the knowledge and skills acquired by undergraduates as a result of mastering theoretical disciplines, develops practical skills and contributes to the formation of universal and general professional competencies. The purpose of pedagogical practice is to study the basics of pedagogical and educational–methodical work in universities, mastering pedagogical skills of conducting training sessions and preparing teaching materials in the disciplines of the educational program "Seismology".	10	✓	✓			✓	

		The basis for conducting pedagogical practice is the Department of Geophysics of the GOGBI NPJC KazNRTU named after K.I.Satpayev. The objectives of the practice are to gain experience in teaching work, as well as: - formation of a holistic view of pedagogical activity, pedagogical systems and the structure of higher education; - development of stable skills of practical application of professional and pedagogical knowledge obtained in the process of theoretical training; - development of professional and pedagogical orientation of undergraduates; familiarizing them with real problems and tasks solved in the educational process; studying methods, techniques, technologies of pedagogical activity in higher education.							
Cycle of basic disciplines Component of choice									
4	Seismic statistics	The course reflects the current state of the theory and practice of determining and identifying statistical patterns of the seismic regime in the energy, geometric and temporal areas. The law of Gutenberg-Richter law, the hierarchy of Sadowski, the fractal geometry of seismicity, temporal clustering of earthquakes. Seismic cycle and the frequency of occurrence of earthquakes. The problem of comparing the results of seismic statistics with the conclusions of physical theories of destruction. Problems of space-time connectivity and self-similarity of seismic process. Scale effect, its physical and methodical reasons. Problems of laboratory modeling of seismic process.	5	✓	✓			✓	✓
5	Models and basic parameters of the seismic regime	The course studies the problems of earthquake prediction based on modeling. Earthquake preparation models are considered and physical grounds for their prediction are given. Model of the process of stretching the earth's crust. Formation of rift structures. Types of laboratory modeling, stages of preparation and implementation of earthquake sources, as a result of laboratory modeling. Stages of preparation of tremors, various temporary (long-, medium- and short-term) precursors. Strategy of predictive algorithms.	5	✓	✓			✓	✓

6	Intellectual property and the global market	Global aspects of intellectual property and its role in international trade and economics, analysis of international agreements and conventions, IP management strategies, cases of protection and violation of intellectual property rights in various jurisdictions.	5	✓	✓			✓	
7	Energy and magnitude characteristics of seismic sources	The course is designed to study the energy and magnitude characteristics of seismic sources. The concepts of magnitude, energy class and magnitude of an earthquake. The concept of seismic intensity as a characteristic of the impact, the effect at a given point of observation. The concept of the magnitude of the earthquake source and its assessment (magnitude or energy class). Seismic intensity scales MSK-64. Classification of structures and damage. Types of structures and buildings without anti-seismic reinforcements. Classification of damage. The concept of the seismic effect	5	✓	✓			✓	✓
Cycle of profile disciplines University component									
8	Research practice	Research practice strengthens the knowledge and skills acquired by doctoral students as a result of mastering theoretical disciplines, develops practical skills and contributes to the comprehensive formation of professional and general professional competencies. The objectives of research practice are: - mastering by doctoral students of methods and principles of conducting field and desk geophysical work, studying methods of planning such work; obtaining experimental (theoretical, laboratory, field) material for writing a doctoral dissertation; - consolidation of the skills of scientific or industrial work in Seismology; formation of their skills and abilities to compile scientific and technical reports and public presentations; - organization of practical use of the results of scientific research, including publications, promotion of the results of their own scientific activities. The objectives of the research practice are: - ensuring the direct participation of doctoral students in research works on Seismology; obtaining the necessary material to solve a scientific problem or a practical bare-geophysical problem; - obtaining practical knowledge on the identification of oil and	10	✓	✓			✓	✓

		gas prospective structures and ore areas, nodes and fields, deposits of solid minerals; - study of data collection and storage systems and methods of their processing, interpretation and modeling; mastering technical means of presenting scientific results; - acquisition of professional competencies in accordance with the types and tasks of geological exploration. The content of the doctoral student's research practice in the direction of "Seismology" depends on the orientation, the task and the topic of the doctoral dissertation. The research practice plan is drawn up individually for each doctoral student and is a program of theoretical, experimental or field work.							
Cycle of profile disciplines Component of choice									
9	Modern methods of seismic hazard assessment	The course "Modern methods of seismic hazard assessment" considers the possibilities and methods for determining the magnitude of seismic effects from earthquakes (intensity in points or in other physical characteristics) expected at a given point and the probability of their occurrence for a certain waiting time. The theoretical foundations of methods for compiling and analyzing maps of seismic zoning, the methodology for seismic risk analysis, and seismic hazard forecasting are considered.	5	✓	✓			✓	✓
10	Seismogenerating zones and methods of their isolation	He studies the methodology for identifying geodynamically active zones of the platform and geosynclinal regions of the Republic of Kazakhstan and modern technologies for mapping according to seismotectonic conditions. Basic principles, tasks and goals of seismic zoning of different scales and seismic hazard assessment. The use of a set of maps in the design and construction of facilities, when choosing the normative seismicity. A technique for constructing a seismotectonic map of the latest active geodynamic zones of the platform and geosynclinal parts of the study area for the prospective location of especially important objects.	5	✓	✓			✓	✓
11	Seismic impacts in the parameters of intensity and peak	The basics and methods of processing and analyzing seismological data related to the construction of mathematical and computer models for solving applied problems are studied. Seismic intensities and effects, peak accelerations, ground displacement velocities, seismic	5	✓	✓			✓	✓

	accelerations	loads and the spectrum of responses to them, methods for measuring seismic accelerations, principles of seismic load normalization, macroseismic effects during earthquakes are considered. Competences are related to the assessment of regulatory seismic impacts and construction rules in seismically hazardous regions.							
12	Seismogeophysical precursors and earthquake prediction strategy	The purpose of the course is to form in-depth knowledge about the regularities and physical nature of seismogeophysical precursors in order to develop an earthquake prediction strategy. The statistical and physical aspects of seismogeophysical precursors of earthquakes are studied, on the basis of which methods for detecting anomalies in variations in the parameters of geophysical fields caused by the local process of earthquake preparation are considered. Seismic, deformational, geochemical, electromagnetic and other precursors: patterns of manifestation and theoretical estimates. Parameters of seismogeophysical precursors.	5	✓	✓		✓	✓	✓
13	Hydrochemical and hydrodynamic precursors of earthquakes.	Hydrochemical and hydrodynamic precursors of earthquakes, which manifest themselves in the groundwater regime before strong earthquakes, as well as fast and slow precursor effects, are studied. The mechanisms of formation of hydrogeochemical and hydrodynamic precursor effects are considered; correlation between relative deformations of the earth's surface and changes in effects; seismic hazard assessments and anomalous properties of time series: mean value, variance, oscillation spectrum before the manifestation of a seismic event.	5	✓	✓			✓	✓
14	Earthquake focus models and stages of its formation	The concepts and models of earthquake preparation, the structure of the tectonosphere, the patterns of its deformation and destruction, the physics of the earthquake source, and structural-mechanical modeling based on technogenic deformation processes are studied. Deformation processes in rock masses, physical laws and conditions for the occurrence of an unstable state are considered; methods of applying modern geomechanical models to describe the preparation of earthquakes, building models of consolidation and phase transformations, a dilatant-diffuse model and a model of avalanche-unstable fracturing.	5	✓	✓			✓	✓

5. Curriculum of the educational program

NJSC "KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY named after K.I. SATPAY

SATBAYEV UNIVERSITY

APPROVED
Chairman of the Management Board-
Rector of Kazntu named after K.Satbayev
M.Kh.Begentaev
2024 y.

CURRICULUM
of Educational Program on enrollment for 2024-2025 academic year

Educational program 8D05302 - "Seismology"
Group of educational programs D091 - "Seismology"

Form of study: full-time **Duration of study: 3 year** **Academic degree: Doctor of Philosophy (PhD)**

Discipline code	Name of disciplines	Cycle	Total amount in credits	Total hours	Classroom amount lec/lab/pr	SIS (including TSIS) in hours	Form of control	Allocation of face-to-face training based on courses and semesters					
								I course		2 course		3 course	
								1 semester	2 semester	3 semester	4 semester	5 semester	6 semester
CYCLE OF BASIC DISCIPLINES (BD)													
M-1. Module of basic training (university component)													
MET322	Methods of scientific research	BD UC	5	150	2/0/1	105	E	5					
LNG305	Academic writing	BD UC	5	150	0/0/3	105	E	5					
component of choice													
GPH327	Seismic statistics	BD CCH	5	150	2/0/1	105	E	5					
GPH328	Models and basic parameters of the seismic regime												
MNG349	Intellectual property and the global market												
GPH329	Energy and magnitude characteristics of seismic sources												
CYCLE OF PROFILE DISCIPLINES (PD)													
M-2. Module of professional activity (component of choice)													
GPH298	Modern methods of seismic hazard assessment	PD CCH	5	150	2/0/1	105	E	5					
GPH330	Seismogenerating zones and methods of their isolation												
GPH331	Seismic impacts in the parameters of intensity and peak accelerations												
GPH317	Seismogeophysical precursors and earthquake prediction strategy	PD CCH	5	150	2/0/1	105	E	5					
GPH332	Hydrochemical and hydrodynamic precursors of earthquakes.												
GPH333	Earthquake focus models and stages of its formation												
M-3. Practice-oriented module													
AAP350	Pedagogical practice	BD UC	10						10				
AAP355	Research practice	PD UC	10							10			
M-4. Experimental research module													
AAP336	Research work of the doctoral student, including internships and doctoral dissertation	RWDS UC	5					5					
AAP347	Research work of the doctoral student, including internships and doctoral dissertation	RWDS UC	40						20	20			
AAP356	Research work of the doctoral student, including internships and doctoral dissertation	RWDS UC	60								30	30	
AAP348	Research work of the doctoral student, including internships and doctoral dissertation	RWDS UC	18										18
M-5. Module of final attestation													
ECA303	Writing and defending a doctoral dissertation	FA	12										12
Total based on UNIVERSITY:								30	30	30	30	30	30
								60		60		60	

Number of credits for the entire period of study					
Cycle code	Cycles of disciplines	Credits			
			university component (UC)	component of choice (CCH)	Total
BD	Cycle of basic disciplines		20	5	25
PD	Cycle of profile disciplines		10	10	20
	Total for theoretical training:	***0***	***30***	***15***	***45***
	RWDS				***123***
FA	Final attestation	12			12
	TOTAL:	**12**	**30**	**15**	**180**

Decision of the Academic Council of Kaznu named after K.Satpayev. Protocol № 10 **от "** 22 **"** 04 **20** 24 **y.**

Decision of the Educational and Methodological Council of Kaznu named after K.Satpayev. Protocol № 6 **от "** 19 **"** 04 **20** 24 **y.**

Decision of the Academic Council of the Institute GiNGD. Protocol № 12 **от "** 08 **"** 04 **20** 24 **.**

Vice-Rector for Academic Affairs — **R.K. Uskenbaeva**

Director of the GiNGD Institute — **A.H. Syzdykov**

Head of the Department of Geophysics and Seismology — **B.T. Ratov**

Specialty Council representative from employers — **D.M. Khitrov**