SATBAYEV UNIVERSITY

Institute of Geology and Oil and Gas Business named after K.Turysov

Department of Geophysics

EDUCATIONAL PROGRAM

8D05302 - Seismology

The code and the name of the educational program

The code and the classification of the area of education: 8D05-Natural sciences, mathematics and statistics
The code and the classification of areas of study: 8D053-Physical and chemical sciences
Group of educational programs: D091 - Seismology
NQF Level: 8
IQF Level: 8
Training period: 3 years
Volume of credits: 180

Almaty 2022

Submitted and recommended for approval at a meeting of the Educational and Methodological Council of KazNRTU named after. K.I. Satpaeva.

Minutes No. 4 dated January 14, 2020

The educational program 8D05302 - "Seismology" was developed by the academic committee in the direction 8D053 Physical and chemical sciences

Full name	Academic degree/ academic title	Job title	Work place	Signature
Chairman of the Academic Committee:				
Iskakov R.M.	Professor, PhD	Vice-Rector for Academic Work	JSC KazNRTU named after K.I.Satpayev	
Faculty members:				
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Providers of works				
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Table of contents

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;
KazNITU – Kazakh National Research Technical University;
MES RK – Ministry of Education and Science of the Republic of Kazakhstan;
NQF – National Qualifications Framework;
Research and development–research work;
O – universal, social and ethical competencies
IQF – Industry Qualifications Framework;
PC – professional competencies;
Teaching staff – teaching staff;
Russian Academy of Sciences – Republican Academy of Sciences of the Russian Federation;
RO – learning outcomes of the educational program;
C – special and managerial competencies;

1. Description of the educational program

Doctoral studies in the field of Seismology stimulate 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 program in the direction of "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 direction of "Seismology" include training 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 field of professional activity of graduates who have mastered the doctoral program in the field of training "Seismology" includes solving problems requiring the application of fundamental and applied knowledge in Earth sciences within the framework of the main directions of scientific research and includes the study of: 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 graduates of the doctoral program in the field of "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 received fundamental and professional training, doctors in the field of training "Seismology" can perform the following 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

Purpose of the EP:

Training of specialists in seismology with an international level of competence capable of solving complex problems in seismotectonics and geodynamics, geophysical characteristics of earthquake-prone regions, spatial and temporal patterns of seismicity and parameters of the seismic regime, deterministic and probabilistic assessments of seismic hazard and its prediction, earthquake risks, prediction of the location, strength of future seismic events, the study of potential earthquake foci, based on the fundamental features of the known focal zones.

Tasks of the EP:

- 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	Note
1	Code and classification of the field of education	8D05 Natural sciences, mathematics and statistics
2	Code and classification of training areas	8D053 Physical and chemical sciences
3	Group of educational programs	D091 Seismology
4	Name of the educational program	8D05302 Seismology
5	**Brief description of the educational program**	The program for the preparation of doctors in the direction of "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	Purpose of the EP	Training of specialists in seismology with an international level of competence capable of solving complex problems in seismotectonics and geodynamics, geophysical characteristics of earthquake-prone regions, spatial and temporal patterns of seismicity and parameters of the seismic regime, deterministic and probabilistic assessments of seismic hazard and its prediction, earthquake risks, prediction of the location, strength of future seismic events, the study of potential earthquake foci, based on the fundamental features of the known focal zones.
7	Type of EP	New
8	The level of the NQF	8
9	The level of the IQF	8
10	Distinctive features of the EP	no
11	**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:** RO1: to demonstrate advanced knowledge formed on the basis of a systematic study of fundamental and applied geophysics about natural seismic processes occurring in the Earth; RO2: to 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 of the base of geological and geophysical data; RO3: to apply knowledge and understanding in planning, developing, implementing and analyzing a complex process of scientific seismological research based on in-depth competencies to solve problems of seismology; RO4: to carry out seismological field measurements, visualize the results based on comparison with complex data and develop conclusions, scientific conclusions to identify the features of the results of the work; RO5: synthesize original ideas, research results in scientific publications of national or international level in order to expand the boundaries of the scientific field and make a scientific contribution to the seismological industry; RO6: to use one's own assessment of the latest domestic or foreign experience in forming an original judgment of a professional problem and conducting 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
17	Academic degree awarded	Doctor of Philosophy Ph.D.
18	Developer(s) and authors:	Professor Abetov A.E., 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)					
				RO1	RO2	RO3	RO4	RO5	RO6
Cycle of basic disciplines University component									
1	Methods of scientific research	The formation of doctoral students' knowledge about approaches and various levels of scientific knowledge, the stages of solving fundamental and applied problems, including the choice of areas of research, the formulation of scientific and technical problems, the development of abilities in the methodology of the formation of scientific theories, conducting theoretical and experimental research, recommendations for the design of the results of scientific work. Formation of an in-depth interdisciplinary understanding of: - the main features of the development of science, concepts of scientific revolutions. - the essence and methodological foundations of scientific research; - theoretical principles of scientific research and the deepening of knowledge about the methods of scientific cognition, the application of logical laws and rules; - specifics and structure of knowledge in the fields of geology, geophysics and seismology; - social functions of geological, geophysical and seismological sciences, the subject and objectives of scientific research.	2/0/1	✓		✓	✓	✓	

2	Academic writing	The discipline forms skills and competencies for expressing the results of scientific research in the form of a clear, argumentative scientific text. The results of the training will help in working with information in various scientometric databases, in creating your own original view of a particular solution of scientific research, in reviewing scientific articles related to the direction of study	0/0/3						✓
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 "Oil and gas and ore geophysics". The basis for conducting pedagogical practice is the Department of Geophysics of the IGNGD KazNITU 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;	6			✓		✓	✓

		- 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 purpose of the course is to provide doctoral students with knowledge and modern ideas about the statistical laws of the seismic regime in the energy, spatial and temporal domains; Gutenberg-Richter law, Sadovsky hierarchy, fractal geometry of seismicity, temporal and spatial grouping of earthquakes; seismic cycle and earthquake recurrence. The focus of attention will be put on: - familiarity with the statistical patterns of the seismic regime in the energy, spatial and temporal domains; - study of the Gutenberg-Richter law, Sadovsky hierarchy, fractal geometry of seismicity, temporal and spatial grouping of earthquakes; - gaining knowledge about the seismic cycle and the recurrence of earthquakes; - about the physics and seismicity of the Earth, seismotectonics.	2/0/1	✓	✓				✓
5	Models and basic parameters of the	The course is aimed at studying the problem of earthquake prediction based on	2/0/1	✓	✓				✓

	seismic regime	modeling. Much attention is paid to: - earthquake preparation models and the physical basis for their prediction; - models of the process of stretching the earth's crust, the formation of rift structures; - types of laboratory modeling, stages of preparation and implementation of earthquake foci, as the results of laboratory modeling; - stages of preparation of aftershocks, various temporary (long-, medium- and short-term) precursors; - strategy of predictive algorithms.							
6	Energy and magnitude characteristics of seismic sources	The course is designed to study the energy and magnitude characteristics of seismic sources. Concepts and terminology are given: - magnitude, energy class and magnitude of the earthquake; - seismic intensity as a characteristic of the impact, effect at a given observation point; - magnitude of the earthquake source and its assessment (magnitude or energy class); - MSK-64 seismic intensity scales; - classification of structures and damages; - types of structures and buildings without antiseismic reinforcements; - classification of damages; - seismic effect.	2/0/1	✓	✓				✓
Cycle of profile disciplines University component									

7	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 oil and gas and ore geophysics; 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 oil and gas and ore geophysics; obtaining the necessary material to solve a scientific problem or a practical bare-geophysical problem; - obtaining practical knowledge on the identification of oil and 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,	10		✓		✓	✓	✓

		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 "Oil and gas and ore geophysics" 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									
8	Modern methods of seismic hazard assessment	The purpose of the course is to acquire and consolidate modern knowledge about the fundamental laws, nature and basic laws of seismicity of the Earth as a whole and the seismic regime of various areas, principles and methods of seismic hazard assessment, seismotectonics, seismic zoning and earthquake forecasting. The course examines the possibilities and methods of determining the magnitude of seismic impacts from earthquakes (intensity in points or in other physical characteristics) expected at this point and the probability of their occurrence during a certain waiting time. Special attention is paid to the analysis of various seismogeophysical states to identify seismogenerating zones and assess their seismic potential; the development of a seismotectonic model of the region and	2/0/1	✓	✓			✓	✓

		the assessment of seismic regime parameters based on a complex of geological, geophysical and seismological data; calculation and construction of seismic hazard assessment maps.							
9	Seismogenerating zones and methods of their isolation	The purpose of the course is to acquire and consolidate modern knowledge on: - methodology for the allocation of geodynamically active zones of the platform and mountain-folded regions of the Republic of Kazakhstan and modern technologies for mapping seismotectonic conditions; - the basic principles, objectives 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 regulatory seismicity. The focus of attention is put on the methodology of constructing seismotectonic maps of the newest active geodynamic zones of the platform and mountain-folded areas for the prospective placement of particularly important objects.	2/0/1	✓	✓				✓
10	Seismic impacts in the parameters of intensity and peak accelerations	The purpose of the course is to provide doctoral students with knowledge and modern ideas about the basics and methods of processing and analyzing seismological data related to the construction of mathematical and computer models for solving applied problems. The objectives of the course are to form an in-depth understanding of the - seismic intensity and impacts, peak accelerations;	2/0/1	✓	✓				✓

		- ground displacement rates, seismic loads and the spectrum of reactions to them; - the method of measuring seismic accelerations; - principles of normalization of seismic loads; - macroseismic effects in earthquakes. Competencies are related to the assessment of regulatory seismic impacts and construction rules in seismically hazardous regions.							
11	Seismogeophysical precursors and earthquake prediction strategy	The purpose of the course is to provide doctoral students with knowledge and modern ideas about earthquake seismogeophysical precursors; earthquake prediction and the physical picture of the earthquake preparation process; about promising directions in solving problems of forecasting earthquakes, mountain impacts and other catastrophic phenomena of a similar nature. The objectives of the discipline are to form an in-depth understanding of the: - seismogeophysical precursors of earthquakes; - the concept of harbingers, its statistical and physical aspects; - classification of harbingers; - methods for detecting anomalies in variations in the parameters of geophysical fields (seismic, magnetic, electric, electromagnetic, gravitational, etc.) caused by the local earthquake preparation process.	2/0/1	✓	✓			✓	✓
12	Hydrochemical and hydrodynamic	The course is aimed at studying the hydrochemical and hydrodynamic	2/0/1	✓	✓				✓

	precursors of earthquakes.	precursors of earthquakes, manifested in groundwater regimes before strong earthquakes; fast and slow precursor effects. 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; estimates of seismic hazard and anomaly properties of time series: mean value, dispersion and spectrum of oscillations before the manifestation of a seismic event.							
13	Earthquake focus models and stages of its formation	The course is aimed at studying the concept and model of earthquake preparation, the structure of the tectonosphere, the laws of its deformation of destruction, the physics of the earthquake focus, structural and mechanical modeling based on technogenic deformation processes. Deformation processes in rock massifs, 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, the construction of models of consolidation and phase transformations, dilatant-diffuse models and models of avalanche-unstable cracking.	2/0/1	✓	✓				✓
14	Research work of a doctoral student, including internships and the completion of	The research work of a doctoral student (RWDS) has a theoretical, methodological or computational nature. Performed at the Department of Geophysics and includes:		✓	✓				✓

	a doctoral dissertation (RWDS)	- study of literature on seismology and fundamental geophysics, including achievements of domestic and foreign science and technology in the field of seismology; - collection, processing, analysis and systematization of seismological and geological-geophysical information on the topic of the dissertation; - participation in scientific and applied research, including with the use of modern software; preparation of separate sections of scientific reports on seismological and geological-geophysical studies performed at the Department of Geophysics; - preparation of reports at intra-university, regional or international scientific conferences. R&D should: - correspond to the main problems of the dissertation topic; - be relevant, contain scientific novelty and practical significance; - be based on modern theoretical, methodological and technological achievements of science and practice in seismology; - be carried out using modern methods of scientific research; - contain research (methodological, practical) sections on the main protected provisions; - be based on the best international experience in the relevant field of knowledge.							

5. Curriculum of the educational program

KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY named after K.I.SATPAYEV

SATBAYEV UNIVERSITY

APPROVED
Chairman of the Management Board Rector of KazNITU named after K.I.Satpayev
_____M.M.Begentaev
«____» _____ 2022 y.

CURRICULUM

EDUCATIONAL PROGRAMS for recruitment for the 2022-2023 academic year

Educational program 8D05302 Seismology

Group of educational programs D091 Seismology

Form of study: full-time **Period of study:** 3 years **Academic degree:** Doctor of Philosophy Ph.D.

Discipline code	Name of disciplines	Cycle	Total amount in loans	Total hours	Classroom volume of lek/lab/pr	SRS (including SRSP) in hours	Form of control	Distribution of classroom classes by courses and semesters					
								I course		2 course			
								1 term	2 term	3 term	4 term	5 term	6 term
ЦИКЛ CYCLE OF BASIC DISCIPLINES (BD)													
M-1. Basic training module (university component)													
GPH323	Methods of scientific research	BD UK	5	150	2/0/1	105	Э	5					
LNG305	Academic Writing	BD UK	5	150	0/0/3	105	Э	5					
Component of choice													
GPH327	Seismic statistics	BD CC	5	150	2/0/1	105	Э	5					
GPH328	Models and basic parameters of the seismic regime												

GPH329	Energy and magnitude characteristics of seismic sources												
CYCLE OF PROFILE DISCIPLINES (PD)													
M-2. Profile training module (optional component)													
GPH298	Modern methods of seismic hazard assessment	PD, CC	5	150	2/0/1	105	Э	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, CC	5	150	2/0/1	105	Э	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 UK	10						10				
AAP355	Research practice	PD UK	10							10			
M-4. Research module													

AAP336	Research work of a doctoral student, including internships and the completion of a doctoral dissertation	RWDS (UK)	5					5					
AAP347	Research work of a doctoral student, including internships and the completion of a doctoral dissertation	RWDS (UK)	40						20	20			
AAP356	Research work of a doctoral student, including internships and the completion of a doctoral dissertation	RWDS (UK)	60								30	30	
AAP348	Research work of a doctoral student, including internships and the completion of a doctoral dissertation	RWDS (UK)	18										18
M-5. Module of final certification													
ECA303	Writing and defending a doctoral dissertation	FC	12										12
	Total by UNIVERSITY:							30	30	30	30	30	30

Number of credits for the entire period of study					
Cycle code	Cycles of disciplines	Credits			
			university component (UC)	component of choice (CC)	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***
FC	Final certification	12			12
	TOTAL:	**12**	**30**	**15**	**180**

The decision of the Academic Council of KazNRTU named after K. Satbayev.
Protocol № 13 of «28» 04 2022

The decision of the Educational and Methodological Council of KazNITU named after K.Satbayev.
Protocol №. 7 of «26» 04 2022

Decision of the Scientific Council of the Institute of Geology and Oil and Gas Business
Protocol № 4 of «30» 12 2021

Vice-Rector for Academic Affairs **B.A.Zhautikov**

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

Head of the Department **A.E.Abetov**

Representative of Specialty council **D.M. Khitrov**