Institute of Geology and Oil and Gas named after K. Turysov
Department of Geophysics and Seismology

EDUCATIONAL PROGRAM
Specialized Doctoral Program
8D05303 Applied Seismology

Code and classification of the field of education: 8D05 Natural sciences, mathematics and statistics
Code and classification of training directions: 8D053 Physical and chemical sciences
Group of educational programs: D091 Seismology
Level based on NQF: 8
Level based on IQF: 8
Study period: 3 years
Amount of credits: 180

Almaty 2024

The educational program has been reviewed and recommended for approval at the meeting of the Educational and Methodological Council of Satbayev University (KazNITU named after K.I. Satpayev), Meeting No. 6, dated April 19, 2024.

It has also been reviewed and recommended for approval at the meeting of the Academic Council of Satbayev University, Protocol No. 12, dated April 22, 2024.

The educational program 8D05303 "Applied Seismology" was developed by the Academic committee based on direction 8D053 "Physical and Chemical Sciences".

Full name	Academic Degree/ academic title	Position	Workplace	Signature
Teaching staff:				
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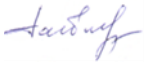
Muzapparova Akerke Bakbergenovna	Master of Engineering Sciences	Teacher	JSC "Kazakh National Research Technical University named after K.I. Satpayev"	
Kiseeva Shyryn Orkenkyzy	Master of Engineering Sciences	Teacher	JSC "Kazakh National Research Technical University named after K.I. Satpayev"	
Employers:				
Mikhailova Natalya Nikolaevna	Doctor of Physical and Mathematical Sciences	Supervisor	Kazakhstan National Data Center (KNDC)	
Uzbekov Nursarsen Bolataevich	Candidate of Physical and Mathematical Sciences	Deputy Director for Science	Institute of Geophysics	
Students				
Dosymbekova Zhansaya	Master of Engineering Sciences	Doctoral student 2nd year of study	Institute of Geophysics	
Isagali Asem	Master of Engineering Sciences	Doctoral student 2nd year of study	Kazakhstan National Data Center (KNDC)	

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List of abbreviations and designations

B – Basic knowledge, skills, and abilities;
HEI – Higher Education Institution;
SEES – State Educational Standards;
ICT – Information and Communication Technologies;
NJSC «KazNJSC named after K.I.Satbayev» – Non-profit joint stock company «Kazakh national research technical university named after K.I. Satbayev»;
SDG-Sustainable Development Goal;
NQF – National Qualifications Framework;
IQF – Industry Qualifications Framework;
R&D – Research and Development;
G – General human, social, and ethical competencies;
PC – Professional Competencies;
APS – Academic and Pedagogical Staff;
LO – Learning Outcomes of the Educational Program;
S – Specialized and Managerial Competencies;
EP-educational program;
BD- basic discipline;
PD- profile discipline;
UC- University component;
CC-Component of choice;
FA- final assessment;
RWDS - research work doctoral student.

1. Description of the educational program

Doctoral studies in the field of "Applied Seismology" stimulates the formation of professional competencies necessary for solving complex seismic geophysical 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; development of non-standard solutions in problem situations; adaptation to new situations, re-evaluation of accumulated experience, creation of new knowledge based on seismic geophysical research; setting innovative professional tasks in the field of research and practical activities; search for optimal solutions to professional problems taking into account their validity, cost, information, social and economic security; solving management problems in the conditions of real operating production structures.

PhD program in Applied Seismology provides:

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

b) the formation of knowledge in the required volume for the study of earthquake foci, displacements of Earth blocks along faults and other transformations of the environment in foci, conducting detailed studies of the processes of earthquake preparation in a real physical and geological environment, performing assessments of foci parameters, identifying earthquake precursors and developing long-term, medium-term and short-term earthquake forecasts, methods of managing the seismic process, assessing the anthropogenic (technogenic) impact on seismicity.

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

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

Doctoral studies in the field of "Applied Seismology" include training in working with modern computer programs for processing seismological data.

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

Field of professional activity:

Graduates who have completed the doctoral program in "Applied Seismology" engage in solving complex problems that require the application of fundamental and applied knowledge in Earth sciences. Their professional activities are centered around key areas of scientific research, including the study of: a) The structure and material composition of the Earth's lithosphere b) The seismic process, which is interconnected with physical geography, geology, tectonics—particularly neotectonics and seismotectonics—as well as the mathematical theory of stochastic processes and cosmophysics

The study of the source and precursors of an earthquake 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, and geochemistry.

The problem of earthquake prediction is close to the problem of rock burst prediction, which is studied by mining sciences. Research near the earthquake source takes into account the achievements of engineering geology and is necessary for the development of earthquake-resistant construction.

The use of seismic waves to study the internal structure of the Earth requires the application of methods of mathematical physics and a 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 training "Applied Seismology" are the lithosphere and tectonosphere of the Earth, their composition, structure, evolution; rocks; geophysical fields; natural and man-made geological and hydrogeochemical processes, physical and geological models of the layers of the Earth's lithosphere; earthquake foci, their monitoring and forecasting; 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 field of training "Applied Seismology" can perform the following types of activities:

a) organizational and managerial activities :

- planning, organization and management of scientific research and scientific production field, laboratory and interpretation seismic and geophysical work;
- development of operational plans for the work of seismological teams and detachments;
- selection and justification of scientific, technical and organizational solutions based on seismic geophysical data and economic calculations.

b) research activities :

- independent selection and justification of the goals and objectives of scientific seismological and geological-geophysical research;
- mastering methods for solving assigned tasks during monitoring and interpretation studies using modern seismic geophysical equipment, devices and information technologies;
- analysis and generalization of the results of scientific research using modern achievements of science and technology, advanced domestic and foreign experience in the field of seismology;
- preparation of scientific reports, publications, papers, drafting applications for inventions and discoveries.
- planning and organizing scientific and scientific-industrial seminars and conferences.

c) scientific and production activities:

- independent preparation and implementation of research, monitoring and interpretation studies in solving practical problems in the field of seismology;
- independent selection, preparation and professional operation of modern seismic geophysical equipment and devices;
- 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 scientific research and practical problems in the field of seismology;
- participation in the development of regulatory and methodological documents in the field of seismic geophysical research.

d) project activities :

- design and implementation of scientific and technical projects in the field of seismology;
- participation in the examination of projects for scientific research seismological work.

d) scientific and pedagogical activity:

- participation in the preparation and conduct of seminars, laboratory and practical classes;
- participation in the management of scientific research work of students in the field of seismology.

Areas of professional activity:

In the profile direction are:

- organizational and technological; design and calculation; service and operational; production and technological activities in:
- academic and departmental research organizations related to solving seismic geophysical problems;

- in the akimats of regions, cities, in the Ministry of Emergency Situations and the departments of the Department of Emergency Situations and the Committee on Emergency Situations;
- in organizations related to environmental monitoring and solving environmental problems.

2. Purpose and objectives of educational program

Purpose of EP:

The goal of the educational program is to prepare doctoral students in a specialized field with an advanced level of professional training in the study of natural seismic processes occurring within the Earth. This aims to shape highly skilled specialists capable of independently addressing strategic seismology tasks, managing projects, and influencing the development of the field.

Tasks of EP:

- 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 concepts of the nature and patterns of seismicity and seismic regime of various areas, modern models of the physics of earthquake sources and the processes of their preparation, principles and methods of seismic hazard assessment, seismic zoning and earthquake forecasting;
- acquisition of skills in planning experiments to study the deep structure of the Earth using seismic and geophysical methods, conducting instrumental seismic and geophysical observations, processing and interpreting the data obtained, determining the parameters of earthquake sources based on seismic records and macroseismic manifestations, planning and conducting work on general, detailed and microseismic zoning, forming conclusions on the seismic hazard of specific territories and objects.
- development of skills for independent scientific research activities and the ability to expand and deepen knowledge in seismology, including mastering new theories and models, mathematical modeling of seismicity processes, etc.;
- acquisition of skills in organizing and conducting seismological research necessary for carrying out scientific work in doctoral studies.
- implementation of knowledge and skills in the field of environmental responsibility, social sustainability and effective project management;
- development of practical skills and competencies for the implementation of engineering solutions that contribute to the achievement of the SDGs.

3. Requirements for evaluating the educational program learning outcomes

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

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

A graduate of the Applied Seismology program must have the ability to:

- abstract thinking, analysis, synthesis of seismic geophysical database; act in non-standard situations, bear social and ethical responsibility for decisions made, show a desire for self-development, self-realization, use of creative potential;
- independently acquire, comprehend, structure and use new knowledge and skills in professional activities, develop their innovative abilities; be able to independently formulate research goals and establish a sequence for solving professional problems; 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 a deep, systematic knowledge of seismic geophysical 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) generalize and analyze experimental information;

d) draw conclusions, formulate findings and recommendations.

A graduate of the Applied Seismology program must:

- be able to use effective methods of processing and interpreting complex information to solve assigned tasks; create and research models of objects under study 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 compiling and preparing scientific and technical documentation, scientific reports, reviews, papers and articles;
- be competent in searching for and interpreting technical information using various search systems (patent search, literature review of magazines and books, the Internet), in the selection and creative use of modern equipment to solve 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 differences, appreciate diverse approaches to understanding and solving social problems;
- be able to organize cooperation in a team, demonstrate creativity and a broad range of interests to solve interdisciplinary problems;
- tolerantly perceive social, ethnic, religious and cultural differences, be capable of criticism and self-criticism, possess skills of interaction and cooperation, be ready to accept the role of a team leader, value the traditions of other cultures, their diversity in modern society, fundamental basic education, economic, social and legal training;
- maintain ethical rules in society, at work and in interpersonal communication, demonstrate the ability to achieve goals and solve problems in non-standard situations.
- to show concern for environmental protection and, by improving their qualifications, to serve the development of the well-being of the whole society .

The educational program is formed taking into account the SDGs:

SDG 4: Education. Ensure inclusive and equitable quality education.

SDG 9: Innovation and infrastructure. Build resilient infrastructure.

SDG 13: Climate action. Sustainable management of natural resources.

Methods and forms of teaching

Lectures and seminars – introduction of the basics of sustainable design and ESG application into theoretical classes.

Practical classes – working with real cases, developing projects with the integration of ESG and SDGs.

Master classes and conferences - inviting industry experts to discuss current issues and practices.

Evaluation of learning outcomes

Knowledge assessment includes tests on the fundamentals of sustainable design and ESG; dissertations are oriented towards the SDGs and ESG.

Teachers

The training involves teachers with industrial experience in the field of applied seismology, as well as knowledge of the principles of sustainable development and the implementation of ESG standards.

4 . Passport of educational program

4.1 General information

No.	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 Applied Seismology
4	Educational program name	8D05303 Applied Seismology
5	Short description of educational program	The program for training doctors in the field of "Applied Seismology" provides: a) training of highly qualified specialists in the field of seismic geophysical methods for assessing seismic hazard, risk and forecasting earthquakes; obtaining by them high-quality and professional knowledge on forecasting the locations of occurrence, strength and recurrence of earthquakes; b) formation of knowledge in the required volume for studying earthquake sources, displacements of Earth blocks and other transformations of the environment in sources, conducting detailed studies of the processes of earthquake preparation in the real physical and geological environment, performing assessments of source parameters, identifying earthquake precursors and developing long-term, medium-term and short-term earthquake forecasts, methods of managing the seismic process, assessing the anthropogenic (technogenic) impact on seismicity; c) qualified solution of engineering and seismological problems, which consists of studying the seismic wave field caused by an earthquake near the source, studying strong seismic movements of the earth's surface and the interaction of soil with a structure, developing methods and conducting seismic microzoning, determining the impact of earthquakes on the hydrosphere and atmosphere of the Earth; d) obtaining by doctoral students high-quality and professional knowledge on the stages and rational complexes of seismic geophysical research, processing, interpretation and modeling of the obtained data.
6	Purpose of EP	The goal of the educational program is to prepare doctoral students in a specialized field with an advanced level of professional training in the study of natural seismic processes occurring within the Earth. This aims to shape highly skilled specialists capable of independently addressing strategic seismology tasks, managing projects, and influencing the development of the field
7	Type of EP	New EP
8	The level based on NQF	8
9	The level based on IQF	8
10	Distinctive features of EP	No
11	List of competencies of 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 standards, including issues of prevention, the ability to use physical education to optimize performance; GC 3 – the ability to analyze the main stages and patterns of historical development of society to form a civic position; GC4 –ability to use the foundations of philosophical knowledge to

		form a worldview position; GC5 – the ability to think critically and solve problems taking into account the principles of sustainable development; GC6 – awareness of the need and acquisition of the ability to independently learn and improve one's qualifications throughout one's working life; GC7 – the meaning and understanding of professional ethical standards, mastery of professional communication techniques; GC8 – the ability to work effectively in a team of specialists with various professional competencies, including the ability to integrate knowledge and methods from different fields, interact with experts from various fields and participate in solving complex interdisciplinary problems; GC9 –ability in the field of engineering network project management taking into account climate change factors and sustainable development principles, including the development and implementation of adaptive solutions to ensure long-term efficiency and environmental sustainability of infrastructure. **General professional competencies (GPC):** GPC-1 – the ability to independently acquire, comprehend, structure and use new knowledge and skills in professional activities, to develop one's innovative abilities; GPC-2 – the ability to apply in practice knowledge of fundamental and applied sections of seismic geophysical disciplines that determine the focus (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 the essence and significance of the relationship between theoretical and practical research in seismology, allowing for the effective and rational study of seismicity processes and mechanisms; reducing 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. 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 formulate diagnostic solutions to professional seismology problems by integrating fundamental and applied sections of geophysics (gravity -magnetic exploration, geoelectrics , seismology and seismic exploration) and specialized geological and geophysical knowledge (about the physical processes occurring in the Earth and the internal structure of the Earth) for the analysis of seismological data and solving seismological problems; PC 3 – ability to provide general technical and administrative management and ensure timely collection of materials for seismological observations. General technical and administrative management and ensure timely completion of work on preparing seismological equipment and observation systems for stationary and field seismological observations; PC 4 –ability to provide general technical and administrative management, planning and ensuring the timely execution of seismic

		recordings at stationary and expeditionary seismic stations, taking into account environmental, social and economic factors; PC 5 – ability to organize, provide general technical and administrative management of digital processing and transformation of primary data into a form that ensures analysis and effective interpretation; PC 6 –ability to compile a seismological database of the study area for the development of an earthquake catalog, operational catalogs and earthquake bulletins. Conducting an 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 in developing a conclusion on the level of seismic activity and the main morphological and kinematic characteristics of identified seismogenic structures. Preparation of complex data for constructing a seismotectonic map, seismic impact maps and seismic zoning. Creation of a digital archive of reporting data; PC 8 – ability to coordinate and manage the interaction of structural divisions when preparing reporting documentation; ability to analyze risks and implement management practices to ensure infrastructure sustainability; PC 9 – development and implementation of innovative solutions for the implementation of sustainable development goals, including ensuring access to clean water, optimizing energy consumption, and creating sustainable cities and ecosystems. PC10 – 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 on the proposed problem, taking into account the latest domestic and foreign experience.
12	Learning outcomes of educational program:	LO1: demonstrate deep and advanced knowledge in the field of applied seismology for high-quality solution of professional problems; LO2: demonstrate skills in synthesizing and integrating geophysical, geological and structural-tectonic knowledge for in-depth problem-solving and solving applied aspects of seismology; LO3: apply skills in working with seismological equipment and instruments, in conducting field seismological measurements, in analyzing results using a priori data to solve problems of applied seismology; LO4: use the skills of processing and interpreting seismological data based on modern software and technologies; LO5: demonstrate a high level of skills in setting strategic seismological objectives, project management and defending conclusions and results as intellectual property on a global scale; LO6: defend your own point of view on a professional problem, argue original ideas when solving problems of monitoring, forecasting and managing risks associated with earthquakes
13	Education form	full-time
14	Period of training	3
15	Amount of credits	180
16	Languages of instruction	Russian
17	Academic degree awarded	Doctor by profile
8	Developer(s) and authors	1). Professor Abetov A.E., 2). Associate Professor Umirova G.K.

4.2. Relationship between the achievability of the formed learning outcomes based on educational program and academic disciplines

№	Discipline name	Short description of discipline	Amount of credits	Generated learning outcomes (codes)					
				LO1	LO2	LO3	LO4	LO5	LO6
Cycle of basic disciplines University component									
1	MET322 Methods of scientific research	**Purpose:** It consists in mastering knowledge about the laws, principles, concepts, terminology, content, specific features of the organization and management of scientific research using modern methods of scientometry**.** **Contents:** structure of technical sciences, application of general scientific, philosophical and special methods of scientific research, principles of organization of scientific research, methodological features of modern science, ways of development of science and scientific research, the role of technical sciences, computer science and engineering research in theory and practice.	5						V
2	LNG305 Academic Writing	**Objective:** to develop academic writing skills and writing strategies for doctoral students in engineering and natural sciences. **Content:** fundamentals and general principles of academic writing, including: writing effective sentences and paragraphs, writing an abstract, introduction, conclusion, discussion, and references; in-text citation; preventing plagiarism; and preparing a conference presentation.	5						V
Cycle of basic disciplines Component of choice									
3	GPH750 Quantitative Seismology	**Purpose:** Study of the deep structure of the Earth based on calculations of seismological characteristics **Contents:** Propagation of seismic waves in the Earth. Global and regional seismicity. Theory of elasticity in seismology. Fundamentals of the dynamic theory of elasticity. Stress and strain tensors. The relationship of stresses and deformations. Elastic energy. Description of seismic sources. Seismic moment. The tensor of the seismic moment. Elastic waves from a point source. A wave field in an infinite homogeneous medium.	5	V	V	V	V		
4	GPH328 Models and main parameters of the	**Objective:** to study the parameters of the seismic regime and statistical methods for modeling the spatio-temporal patterns of the seismic regime	5	V			V	V	V

	seismic regime	**Contents:** In-depth study of seismic event types and methods for describing them. Mathematical and statistical models predicting seismic activity in time and space, taking into account the physical processes underlying seismic activity. Application of statistical methods to interpret seismic activity data, identifying correlations and patterns. Modern tools for modeling seismic regimes							
5	GPH329 Energy and magnitude characteristics of seismic sources	**Objective:** To teach the application of methods and tools for studying the characteristics of seismic sources to improve predictability in a seismically active zone **Contents:** Study of energy and magnitude characteristics of seismic sources. Concepts of magnitude, energy class and earthquake intensity . Seismic effect and seismic intensity as an effect at a given point. Concept of earthquake source size and its assessment (magnitude or energy class). Seismic intensity scales MSK-64. Classification of structures and damages	5	V	V	V	V		
Cycle of profile disciplines University component									
6	Industrial practice	**Objective:** consolidation of knowledge and skills based on the mastery of theoretical disciplines, comprehensive formation of professional and general professional competencies. **The content** of the research practice of a doctoral student in the field of "Oil and Gas and Ore Geophysics" depends on the focus, the task and the topic of the doctoral dissertation. The research internship plan is drawn up individually for each doctoral student and is a program of theoretical, experimental or field work.	20	V	V			V	V
Cycle of profile disciplines Component of choice									
7	MNG349 Intellectual Property and the Global Market	**Purpose:** the goal is to train specialists in the field of intellectual property law who can analyze and predict trends in its development in the global market, develop strategies for the protection and commercialization of intellectual property. **Contents:** 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					V	V
8	GPH748 Engineering seismology and earthquake resistance	Engineering seismology is a section of seismology that studies seismic data necessary for designing stable (earthquake-resistant) structures against earthquakes. Mastering the basic concepts of engineering seismology. Estimating the strength of earthquakes.	5	V		V	V	V	V

		Earthquake intensity. Earthquake recording equipment. Seismograms, velocigrams and accelerograms . Seismic zoning and microzoning. Identifying seismically hazardous areas and preliminary forecasts of the probable seismic impact of a strong earthquake, etc.							
9	GPH330 Seismogenic zones and methods of their identification	Objective: Study of the methodology for identifying geodynamically active zones of platform and geosynclinal regions of the Republic of Kazakhstan and technologies for compiling maps of seismotectonic conditions Contents: Basic principles, tasks and objectives of seismic zoning of different scales and seismic hazard assessment. Use of a set of maps in the design and construction of objects, when choosing standard seismicity. Methodology for constructing a seismotectonic map of the newest geodynamic zones of the platform and geosynclinal parts of the study area for the prospective placement of especially important objects	5			V	V	V	V
10	GPH334 Seismic monitoring and earthquake forecasting	**Objective:** to obtain knowledge on the basic concepts and methods of seismic monitoring , its organization and implementation as a basis for earthquake forecasting and environmental protection activities **Contents: study of** seismic monitoring tasks and equipment features from a seismic station, seismic array to a seismic network. Types of monitoring networks. Study of seismic noise and its characteristics as the main criterion for selecting sites for station placement. Types of data processing and compilation of seismic bulletins and earthquake catalogs. Earthquake forecasting	5			V	V	V	V
1 1	GPH335 Methods of interpretation and modelling of seismological data	**Objective:** To study methods for interpreting and modeling earthquakes and related phenomena for long-term earthquake forecasting **Contents:** The course studies the methodology of complex data analysis for creating an earthquake catalog. Construction of seismic zoning maps. Forecasting the properties of the geological environment. Interpretation of the catalog for earthquake forecasting. Information technologies for interpretation and modeling of seismological data. Modeling of catalog data based on the elastic map method. Morishita index . Algorithm for grouping earthquake epicenters using the Voronov method.	5	V		V	V	V	V
12	GPH336 Physics and mechanisms of	**Objective:** To study the physics, geological aspects and mechanisms of earthquakes **Contents:** Physical parameters of earthquakes. Modern movements of tectonic plates. Distribution of earthquakes by magnitude and	5	V	V				V

	earthquakes occurrence	depth. Seismicity of Kazakhstan. Gutterberg-Richter earthquake recurrence law. Seismically active regions. Displacements and deformations in the earthquake source area. Inelastic displacement in the earthquake source. Relationship of the focal mechanism type with tectonics. Main types of earthquake focal mechanisms and displacements on faults. Time function of the source and vertical section of the seismic focal zone							
13	GPH337 Methodology of observation and processing of seismological data	**Objective:** to study the principles of conducting seismological observations and their processing, storage and visualization **Contents:** Concept of a seismic station network. Permanent networks and networks of temporary local stations. Network of strong motion stations (SSS). Technical means of networks of seismic stations. Short-period and broadband velocimeters. Seismometers. Equipment for digital recording of seismic signals. Data collection and transmission systems. Software for processing seismological observation data. Creation of an operational catalog of earthquakes. Display, control and detection of seismic events. Calculation of earthquake hypocenters	5			**V**	**V**	**V**	**V**
14	Research work of a doctoral student, including internships and completion of a doctoral dissertation (R&D)	**Objective:** to prepare a doctoral student who is proficient in the methodology of scientific knowledge and is able to apply scientific methods in the study of problems of modern seismology in order to write and successfully defend a doctoral dissertation. **Contents:** study of literature on seismology, including achievements of domestic and foreign science and technology in the field of seismology. Collection, processing and systematization of seismological and geological-geophysical information on the topic of the dissertation. Preparation of reports at intra-university , regional or international scientific conferences. Preparation of chapters of a doctoral dissertation	123	**V**			**V**	**V**	
15	ECA303 Experimental research work of a doctoral student, including an internship and completion of a doctoral dissertation	**Objective:** to study the basic requirements, grounds for selection of materials, research directions, the most modern technologies and equipment features for solving the main problems of a doctoral dissertation. **Contents:** Relevance, scientific novelty and practical significance of the dissertation. Review of modern achievements of science, technology and production, specific practical recommendations, independent solutions to complex management problems. Experimental and research (methodological, practical) sections on the main provisions to be defended.	12	**V**			**V**	**V**	

5. Curriculum of the educational program

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

SATBAYEV UNIVERSITY

APPROVED
Chairman of the Management Board-
Rector of Kaznitu named after K.Satpayev
M.Kh. Ibraimtaev
2024 y.

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

Educational program 8D05303 - "Applied Seismology"
Group of educational programs D091 - "Seismology"

Form of study: full-time **Duration of study: 3 year** **Academic degree: Doctor by profile**

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)													
MET 322	Scientific research methods	BD UC	5	150	2/0/1	105	E	5					
LNG 305	Academic writing	BD UC	5	150	0/0/3	105	E	5					
M-2. Module of seismic processes and characteristics of the seismic regime (component of choice)													
GPH 750	Quantitative seismology	BD CCH	5	150	2/0/1	105	E	5					
GPH 328	Models and basic parameters of the seismic regime												
MNG 349	Intellectual property and the global market												
GPH 329	Energy and magnitude characteristics of seismic sources												
CYCLE OF PROFILE DISCIPLINES (PD)													
M-2. Module of Seismology and seismic hazard assessment (component of choice)													
GPH 748	Engineering seismology and seismic resistance	PD, CCH	5	150		105	E	5					
GPH 330	Seismogenerating zones and methods of their isolation												
GPH 334	Seismic monitoring and earthquake forecasting												
GPH 335	Methods of interpretation and modelling of seismological data	PD, CCH	5	150		105	E	5					
GPH 336	Physics and mechanisms of earthquake occurrence												
GPH 337	Methods of observation and processing of seismology data												
M-3. Practice-oriented module													
AAP 371	Industrial intership	PD UC	20						20				
M-4. Experimental research module													
AAP 372	Experimental research work of doctoral student, including internships and doctoral dissertations	ERWDS UC	5					5					
AAP 376	Experimental research work of doctoral student, including internships and doctoral dissertations	ERWDS UC	10						10				
AAP 374	Experimental research work of doctoral student, including internships and doctoral dissertations	ERWDS UC	90							30	30	30	
AAP 375	Experimental research work of doctoral student, including internships and doctoral dissertations	ERWDS UC	18										18
M-5. Module of final attestation													
ECA 303	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		10	5	15
PD	Cycle of profile disciplines		20	10	30
	Total for theoretical training:	*0*	*30*	*15*	*45*
	ERWDS				*123*
FA	Final attestation	12			12
	TOTAL:	**12**	**30**	**15**	**180**

Decision of the Academic Council of Kazntu named after K.Satpayev. Protocol №12 от "28" 04 2024.

Decision of the Educational and Methodological Council of Kazntu named after K.Satpayev. Protocol № 6 от "18" 04 2024.

Decision of the Academic Council of the Institute GiNGD. Protocol №12 от "08" 04 2024 y.

Vice-Rector for Academic Affairs — R.K. Uskenbayeva

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