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

EDUCATIONAL PROGRAM
7M05302 «Seismology»

Code and classification of the field of education: **7M05 «Natural Sciences, Mathematics and Statistics»**
Code and classification of training areas: **7M053 «Physical and chemical sciences»**
Group of educational programs: **M091 «Seismology»**
NQF Level: 7
IQF Level: 7
Duration of training: 2 years
Volume of loans: 120

Almaty 2022

The educational program 7M05302 "Seismology" was approved at the meeting of the Scientific Council of NJSC «KazNRTU named after K.I.Satpayev».
Protocol No. 3 of October 27, 2022.

Reviewed and recommended for approval at a meeting of the Educational and Methodological Council of NJSC«KazNRTU named after K.I.Satpayev».
Protocol No. 2 of January 21, 2022.

The educational program 7M05302 "Seismology" was developed by the academic committee in the direction 7M053 "Physical and Chemical Sciences".

Full name	Academic degree/ academic title	Post	Place of work	Signature
Chairman of the academic committee				
Khitrov Dmitry Mikhailovich	Candidate of Technical Sciences	Manager of the company's data processing center	«PGS Kazakhstan LLP»	
Teaching staff:				
Ratov Boranbay Tovbasarovich	Doctor of Technical Sciences	Head of the Department of "Geophysics"	NJSC "Kazakh National Research Technical University named after K.I.Satpayev"	
Abetov Auez Egemberdyevich	Doctor of Geological and Mineralogical Sciences, Professor	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"	
Togizov Kuanysh Serikkhanovich	Doctor of PhD	Associate Professor	NJSC "Kazakh National Research Technical University named after K.I.Satpayev"	
Muzapparova Akerke Bakbergenovna	Master of Technical Sciences	Teacher	NJSC "Kazakh National Research Technical University named after K.I.Satpayev"	
Employers:				
Kurmanov Baurzhan Koptleuovich	Master of Technical Sciences	General manager	OPTIMUM Design Institute LLP	

Katrenov Zhanibek	Master of Technical Sciences	Senior Geophysicist	Tengizchevroil LLP	
Students				
Ablesenova Zukhra Nigmetzhanova	Master of Technical Sciences	Doctoral student of 1 year 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;
NJSC«KazNTRU named after K.I.Satbayev" – Non-profit joint stock company «Kazakh national research technical university named after K.I. Satbayev»;
MES RK – Ministry of Education and Science of the Republic of Kazakhstan;
NQF – National Qualifications Framework;
U – universal, social and ethical competencies;
IQF – Industry Qualifications Framework;
PC – professional competencies;
LO – learning outcomes of the educational program;
S – special and managerial competencies;
JSC – joint stock company;
LLP - limited liability partnership;
SIS- student independent study;
EP-educational program;
BD- basic discipline;
PD- profile discipline;
UC- University component;
CC-Component of choice;
FA- final assessment.
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1. Description of the educational program

The master's educational program 7M05302 “Seismology” stimulates the formation of in-depth fundamental knowledge among graduates; abstract thinking and originality of analysis that go beyond the issues covered by standards and practice; forms the ability to make non-standard decisions in problem situations; adaptation to new situations, reassessment of accumulated experience, creation of new knowledge based on seismogeophysical research; setting innovative professional tasks in the field of research and practical activities; search for optimal solutions to professional tasks, taking into account their validity, cost, information, social and economic security; solving managerial tasks in the conditions of actual production structures.

Master's educational program 7M05302 “Seismology” ensures the formation of general cultural, general scientific, social, informational, professional and pedagogical competencies in graduates; the development of such personal qualities as responsibility, the desire for self-development and the disclosure of their creative potential, possession of a culture of thinking, awareness of the social significance of the profession of a seismologist, the ability to make organizational decisions in different situations and willingness to take responsibility for them.

The Master's program in the direction of 7M05302 «Seismology» provides:

a) training of highly qualified specialists in the field of seismogeophysical methods of seismic hazard assessment, earthquake risk and prediction;

b) they receive high-quality and professional knowledge on forecasting the places of occurrence, strength and recurrence of earthquakes; conducting detailed studies of earthquake preparation processes in a real physical and geological environment, displacements of Earth blocks and other transformations of the environment in foci, assessing the parameters of the focus, identifying earthquake precursors and those who are able to develop long-term, medium-term and short-term earthquake forecasts, ways to control the seismic process, assess the possibility of anthropogenic (man-made) influence on seismicity;

c) professional solution of engineering and seismological problems in the study of earthquake-induced seismic wave field near the hearth, the study of strong seismic movements of the Earth's surface and the interaction of soil with the structure, the development of methods and conducting seismic micro-zoning, determining the impact of earthquakes on the hydrosphere and the Earth's atmosphere.

d) qualified research away from the earthquake source when studying the wave seismic field at distances exceeding the length of the seismic wave, as well as the development and use of seismic methods of cognition of the internal structure of the Earth. Adjacent to this direction is the study of seismic noise on the Earth's surface - microseism. The applied tasks include registration and recognition of underground nuclear tests by seismic methods.

e) obtaining high-quality and professional knowledge by undergraduates on the stages and rational complex of seismological research, processing,

interpretation and modeling of the data obtained.

The program includes 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.

Graduates receive a Master's degree in Seismology and work at the Institute of Seismology and SOM of the Ministry of Education and Science of the Republic of Kazakhstan, in the IGI of the National Research Center of the Republic of Kazakhstan, in akimats of regions, cities, in emergency situations and emergency situations in engineering positions, in research institutes as researchers.

The content of the Master's EP 7M05302 "Seismology" based on the development of a multi-level system of personnel training, fundamentality and quality of training, continuity and continuity of education and science, unity of training, education, research and innovation activities, aimed at maximizing the satisfaction of consumer demands should ensure:

- training of professional and competitive highly qualified specialists in the field of seismology, capable of applying innovative methods in assessing seismic hazard, risk and earthquake forecasting;
- preparation of masters who know the methodological basis, equipment, technology and methods of conducting seismogeophysical work, methods of processing, interpretation and modeling of the obtained seismological data;
- development of masters' abilities:

a) apply knowledge of fundamental and technical sciences, including mathematics, physics, chemistry;

b) to acquire practical skills of working with seismic and geophysical equipment, modern software for processing, interpretation and modeling of obtained seismological data using modern information technologies;

c) use the methods, skills and modern technical means necessary for assessing seismic hazard, risk and earthquake forecasting;

- formation of masters:

a) the ability to find and work with the necessary literature, computer information, databases and other sources of information to solve the tasks;

b) teamwork skills, but at the same time to show individuality, and if necessary to solve problems independently;

c) to conduct a comprehensive analysis of seismogeophysical data and monitoring of seismological work, as well as to make management decisions based on their results;

- formation of masters of industrial and ethical responsibility, the ability to understand the problem, the ability to work together with various specialists, to find optimal solutions, the need to improve their knowledge and skills;
- knowledge of modern social and political problems, proficiency in state, Russian and foreign languages, market economy tools, safety and environmental issues.

Field of professional activity:

The area of professional activity of masters in EP 7M05302 “Seismology” includes: the study of the structure and material composition of the lithosphere and tectonosphere of the Earth, the study of foci and precursors of earthquakes based on the achievements of solid-state physics, mechanics, 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. The study of the seismic process is in contact with physical geography, tectonics, especially with neotectonics and seismotectonics, with the mathematical theory of random processes, with cosmophysics.

Studies near the hearth 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:

Lithosphere and mantle of the Earth; geophysical fields; natural and man-made geological processes; computerized and software-controlled information-measuring and processing systems and complexes.

Subjects of professional activity:

- Study of the structure, physical models of the Earth's lithosphere and mantle, seismic regime;
- Conducting scientific research using seismogeophysical methods, as well as materials of monitoring observations;
- Processing, interpretation and modeling of the received data, as well as measures to ensure seismic safety and reduce the anthropogenic load on the environment.

Types of professional activity:

Masters in the educational program 7M05302 “Seismology” prepare for research and scientific-production professional activities. In accordance with the received fundamental and professional training, they can perform the following types of activities:

a) organizational and managerial activities:

- planning, organization and management of research and scientific-production field, laboratory and interpretive seismogeophysical works;
- development of operational work plans for seismological stations;
- selection and justification of scientific, technical and organizational solutions based on seismogeophysical data and economic calculations;
- planning and organization of scientific and production seminars and conferences.

b) research activities**:**

- independent selection and justification of the goals and objectives of scientific seismological 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 research results using modern achievements of science and technology, advanced domestic and foreign experience in the field of seismology;
- evaluation of the results of scientific research seismological work, preparation of scientific reports, publications, reports, preparation of applications for inventions and discoveries.

c) scientific and production activitiesность:

- independent preparation and conduct of research, monitoring and interpretation studies in solving practical problems in the field of seismology;
- collection, analysis and systematization of available seismological and geological-geophysical information using modern information technologies;
- complex processing, interpretation and modeling of seismogeophysical information in order to solve research problems in the field of seismology;
- participation in the development of normative methodological documents in the field of seismological 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 the research work of undergraduates.

Areas of professional activity:

With the profile direction: organizational and technological; settlement and design activities in:

- academic and departmental research organizations related to the solution of seismological problems;
- in akimats of regions, cities, in departments of emergency and emergency situations;
- organizations related to environmental monitoring and solving environmental problems.

At the scientific and pedagogical direction:

- educational (pedagogical) activity in various directions in higher educational institutions, scientific activity in information services of research institutions, state administration bodies, educational institutions, design organizations, industrial enterprises.

2. The purpose and objectives of the educational program

EP purpose:

Seismologists education with a high level of theoretical and practical knowledge, capable of organizing and conducting registration, processing and comprehensive analysis of seismological data using advanced recording tools and modern software for research and professional activities.

EP tasks:

With the profile direction:

- Acquisition and consolidation of previously acquired knowledge about the fundamental laws of radiation and propagation of seismic waves in the Earth, theories and methods of studying its internal structure with the help of seismic waves, modern ideas about the nature and basic laws of seismicity of the Earth as a whole and the seismic regime of various fields, modern models of earthquake physics and processes of its preparation, principles and methods of assessment seismic hazard, seismic zoning and earthquake prediction.

- Acquisition of skills in processing, interpretation and modeling of geological and geophysical data, construction of geodynamic and geostatic models of the lithosphere; tectonic zoning of the foundation of platforms and orogenic areas; prediction of the internal structure of deformation-stressed zones.

- Acquisition of experience in the use of technologies for processing seismogeophysical data, skills in working with specialized systems for processing and interpreting these data, the use of engineering and economic calculations of the consequences of earthquakes; demographic and political consequences of them, the necessary forces and means for emergency rescue and other urgent work (AS and DNR), i.e. emergency response; zoning of the seismic risk of cities and settlements, building seismic models for the most typical regions, carrying out theoretical calculations of the main parameters of seismic impacts for them, predicting the degree of destruction on the MSK-64 scale. evaluate the reliability and accuracy of the results obtained.

- Acquisition of the ability to plan experiments to study the deep structure of the Earth by seismic methods, process and interpret the data obtained, conduct instrumental seismic observations, including in the epicentral zone of strong earthquakes, 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 seismic hazard specific territories and objects.

- mastering the skills of installation and maintenance of seismic recording equipment, analysis and interpretation of seismic records, isolation of seismic events, assessment of the location of the focus and determination of earthquake magnitude by seismic waves, intensity of concussions (score) by macroseismic manifestations of an earthquake, compilation and analysis of seismic zoning maps.

At the scientific and pedagogical direction:

- in-depth theoretical and practical training in seismogeophysics, as well as pedagogical activity;
- 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;
- acquisition of skills in organizing and conducting seismological research, obtaining the necessary foundation for continuing scientific work in doctoral studies;
- obtaining knowledge in the field of university pedagogy, psychology and teaching experience at the university.

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

As a result of mastering the master's degree program, the graduate should have deep theoretical knowledge and practical skills in the field of fundamental research of the causes, processes of preparation and occurrence of earthquakes, as well as the consequences associated with them. The main seismological directions include the study of processes in the earthquake focus, the wave seismic field near and far from its focus, the assessment and zoning of seismic hazard, the forecast of strong earthquakes.

The study of the seismic process includes the study of the totality of earthquakes in space and time, the identification of causal and stochastic patterns of their occurrence and connection with the general evolution of the Earth.

A graduate of the Department of Geophysics under the Master's degree program should know: the goals and objectives of seismology in the system of Earth sciences; be aware of the social significance of their future profession, have high motivation to perform professional activities; be able to assess the capabilities of each seismological method and navigate the applicability of individual methods; possess skills in working with seismogeophysical equipment, methods of processing and interpretation of monitoring data. data, including software on a computer, as a means of information management.

A master's degree graduate in EP 7M05302 “Seismology” must: have an idea of current trends in the development of the seismological industry; about its current methodological and philosophical problems; about the current state of the economic, political, legal, cultural and technological environment of global business partnerships.

Graduates of the master's program 7M05302 “Seismology” must have the ability to:

- abstract thinking, analysis, synthesis of a seismological database; be ready to 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 activities, develop their innovative abilities;
- be able to formulate research goals independently and establish a logical sequence for solving professional tasks; apply in practice knowledge of fundamental and applied sections of disciplines that determine the orientation (profile) of the master's degree program.
- possess professional competencies (PC) corresponding to the type of professional activity that the master's degree program is focused on.

Graduates of the master's program 7M05302 “Seismology” should be able to:

- to form diagnostic solutions to seismological problems by integrating fundamental sections of seismological sciences and specialized knowledge; b) to be able to independently conduct scientific and methodological work and research in seismology, generalize and analyze experimental information, draw conclusions, formulate conclusions and recommendations;
- conduct independent research and monitoring work; be able to professionally operate modern equipment and devices.

Graduates of the master's program 7M05302 “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;
- have communication skills to present their suggestions and recommendations in oral and written forms;
- be able to use effective methods of processing and interpreting complex information to solve production problems; build and explore models of the studied objects based on the use of in-depth theoretical and practical knowledge;
- 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 with the use of various search engines (patent search, literary review of magazines and books, the Internet), in the selection and creative use of modern equipment for solving scientific and practical problems of oil and gas and ore geophysics;
- be socially mobile, be able to adapt to new situations in a 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.
- to perceive social, ethnic, confessional and cultural differences with tolerance, to appreciate the traditions of other cultures, their diversity in modern society;
- be capable of criticism and self-criticism, have skills of interaction and cooperation, be ready to accept the role of a team leader;

- be ready to communicate orally and in writing in Kazakh, Russian and foreign languages to solve the tasks of professional activity;
- to 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	7M05 «Natural sciences and mathematics»
2	Code and classification of training areas	7M053 «Physical and chemical sciences»
3	Group of educational programs	M091 «Seismology»
4	Name of the educational program	7M05302 «Seismology»
	Brief description of the educational program	The master's program in EP 7M05302 “Seismology” provides: a) training of highly qualified specialists in the field of seismological methods of seismic hazard assessment, risk and earthquake forecasting; b) obtaining high-quality and professional knowledge on forecasting the places of occurrence, strength and recurrence of earthquakes; conducting detailed studies of earthquake preparation processes in a real physical and geological environment, displacements of Earth blocks and other transformations of the environment in foci, assessing the parameters of the focus, identifying earthquake precursors and those who are able to develop long-term, medium-term and short-term earthquake forecasts, methods of controlling the seismic process, to assess the possibility of anthropogenic (man-made) influence on seismicity; c) professional solution of engineering and seismological problems in the study of earthquake-induced seismic wave field near the hearth, the study of strong seismic movements of the Earth's surface and the interaction of soil with the structure, the development of methods and conducting seismic micro-zoning, determining the impact of earthquakes on the hydrosphere and the Earth's atmosphere. d) qualified research away from the earthquake source when studying the wave seismic field at distances exceeding the length of the seismic wave, as well as the development and use of seismic methods of cognition of the internal structure of the Earth. Adjacent to this direction is the study of seismic noise on the Earth's surface - microseism. The applied tasks include registration and recognition of underground nuclear tests. e) obtaining high-quality and professional knowledge by undergraduates on the stages and rational complexes of seismogeophysical research, processing, interpretation and modeling of the data obtained
6	EP Purpose	Seismologists education with a high level of theoretical and practical knowledge, capable of organizing and conducting registration, processing and comprehensive analysis of seismological data using advanced recording tools and

		modern software for research and professional activities.
7	Type of EP	New EP
8	The level of the NQF	7
9	IQF Level	7
10	Distinctive features of the EP	no
11	Basic knowledge, skills and abilities (B)	B1 –the ability to independently acquire, comprehend, structure and use new knowledge and skills in professional activities, develop their innovative abilities; B2 – the ability to put into practice knowledge of fundamental and applied sections of seismogeophysical disciplines that determine the orientation (profile) of the Master's program in seismology; B3 – the ability to independently design and carry out research activities in the field of seismology using modern research methods and information and communication technologies and on the basis of complex geophysical and interdisciplinary research; B4 – the ability to professionally select and creatively use modern scientific and technical equipment to solve scientific and practical problems of seismology; B5 – understanding of the essence and significance of the interrelation of theoretical and practical research in seismology, allowing to effectively and rationally study the processes and mechanisms of seismicity; reduce the risks of man-made impacts on industrial and civil facilities; B6 – the ability to solve complex problems of seismology using innovative technologies; B7 – knowledge of the goals and objectives of fundamental and applied geophysical research in the areas of activity, the basic principles and methods of their organization; the main sources of information and requirements for the presentation of information materials. B8 – proficiency in the preparation and execution of scientific and technical documentation, scientific reports, reviews, reports and articles in the areas of seismology; B9 – the ability to critically analyze, present, defend, discuss and disseminate the results of their professional activities; B10 – readiness to use modern methods and technologies of scientific communication in the state and foreign languages to solve urgent problems of seismology. **Professional Competencies (PC):** PC1 – the ability to form diagnostic solutions to professional problems of seismology by integrating fundamental and applied sections of geophysics (including gravimagnetic exploration, geoelectrics, seismology and seismic exploration) and specialized geological and geophysical knowledge (including physical processes occurring in the Earth and the internal structure of the Earth) to solve problems of seismology;

		PC2 – to know the promising directions of development and problems of seismology, the current level of elaboration of problems; PC3 – the ability to independently formulate research goals, establish the sequence of solving professional problems in the areas of seismology with the help of modern equipment and equipment, software and information technologies using the latest domestic and foreign experience; PC4 – the ability to independently conduct scientific experiments and research in seismology, generalize and analyze experimental information, draw conclusions, formulate conclusions and recommendations; PC5 – the ability to freely and creatively use modern methods of processing and interpreting seismological information to solve scientific and practical problems, including those in related fields of knowledge; PC6 – the ability to create and explore models of the studied objects based on the use of in-depth theoretical and practical knowledge in the field of seismology; PC7 - be able to independently compile and submit research projects, prepare and coordinate technical specifications for the development of design solutions; PC8 - possess the skills of professional operation of modern seismological equipment and instruments; PC9 - to identify and systematize the main ideas in scientific publications; to critically evaluate the effectiveness of various approaches to solving seismological problems; to formulate an independent view of the proposed problem taking into account the latest domestic and foreign experience; PC10 - be able to manage scientific and production work in solving complex problems of seismology at the stages of design, execution (including processing, analysis and interpretation), preparation of reports and presentation of results; PC11 - own computer software packages designed to work with a complex of geological and geophysical data. PC12 – master the basic methods of collecting and analyzing, storing and processing scientific and technical information. PC13 - the ability to conduct seminars, laboratory and practical classes (within the framework of domestic and international educational programs) in the field of geophysics (in accordance with the specialization) using modern educational technologies; **Universal, social and ethical competencies (U):** U1 – understanding and practical use of the norms of a healthy lifestyle, including issues of prevention, the use of physical culture to improve performance; U2 – knowledge of the state, Russian and one of the most common foreign languages at a level that ensures human communication;

		U3 – awareness of the need to acquire the ability to study independently and improve their qualifications throughout their working life; U4 – readiness for self-development, self-realization, use of creative potential; U5 - the ability to plan and solve problems of their own professional and personal development. U6 - willingness to act in non-standard situations, to bear social and ethical responsibility for the decisions taken; U7 - готовность действовать в нестандартных ситуациях, нести социальную и этическую ответственность за принимаемые решения. U8 - possess the skills of systematic logical thinking in the analysis of scientific data and the formulation of practical tasks of seismological research. **Special and managerial competencies (S):** S1 – independent management and control of the processes of labor activity within the framework of the strategy, policy and goals of the organization, discussion of the problem, reasoning of conclusions and competent handling of information; S2 – willingness to lead a team in the field of their professional activities, tolerantly perceiving social, ethnic, confessional and cultural differences; S3 – know and master the basic management functions (decision-making, organization, motivation, control) and methods of their implementation; S4 – have organizational skills, be able to create mobile working groups to fulfill their goals and be able to manage such a group, be able to protect their rights and require them to fulfill their duties. S5 – possess: methods and technologies of interpersonal communication, public speaking skills.
12	Learning outcomes of the educational program	ON1: Show deep theoretical and practical knowledge of seismology, based on the features of the cognitive process and the scientific worldview; ON2: Understand and define a methodology for professionally solving seismological problems, based on a deep integrated geological and geophysical knowledge and the foundations of the philosophy of science; ON3: Apply systematic knowledge and skills to organize and perform seismological surveys, independently set research goals and choose a work methodology based on competencies for the implementation of cognitive activities; ON4: Analyze and generalize complex geological and geophysical data to determine interpretation criteria, combine and compare a priori and field information to obtain productive seismological survey materials using modern achievements in science and technology in the field of seismology; ON5: Evaluate modern domestic and foreign scientific

		publications and research results to form an independent opinion in the field of seismology, critically analyze, present, defend, discuss and disseminate the results of their professional activities; ON6: Use modern methods of teaching, education and educational technologies in teaching activities and in managing students' research work; ON7: Carry out communicative interaction in a team, apply knowledge of the philosophy of science to solve problems of professional and personal development, use knowledge, skills and abilities in professional activities.
13	Form of training	full - time
14	Duration of training	2
15	Volume of loans	120
16	Languages of instruction	Russian/Kazakh
17	Academic degree awarded	Master of Science
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	Amount of credits	Формируемые результаты обучения (коды)						
				PO1	PO2	PO3	PO4	PO5	PO6	PO7
Cycle of basic disciplines University component										
1	History and philosophy of science	The subject of philosophy of science, dynamics of science, specifics of science, science and pre-science, antiquity and the formation of theoretical science, the main stages of the historical development of science, features of classical science, non-classical and post-non-classical science, philosophy of mathematics, physics, engineering and technology, specifics of engineering sciences, ethics of science, social and moral responsibility of a scientist and engineer.	3		✓					✓
2	Foreign language (professional)	The course is designed for undergraduates of technical specialties to improve and develop foreign language communication skills in professional and academic fields. The course introduces students to the general principles of professional and academic intercultural oral and written communication using modern pedagogical technologies.	5					✓		✓
3	Higher school pedagogy	Undergraduates will master the methodological and theoretical foundations of higher school pedagogy, plan and organize the processes of teaching and upbringing, master the communicative technologies of subject-subject interaction between a teacher and a master in the educational process of a university.	3						✓	✓
4	Psychology of management	he discipline studies the modern role and content of psychological aspects in managerial activity. The improvement of the psychological literacy of the student in the process of implementing professional activities is considered. Self-improvement in the field of psychology and studying the composition and	3						✓	✓

		structure of management activities, both at the local level and abroad. The psychological feature of modern managers is considered.								
5	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". The basis of 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; - 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; - - development of personal and professional qualities of a teacher.	6			✓		✓	✓	✓
Cycle of basic special disciplines 1 Component of choice										
6	Basic seismology	The course examines the physical concepts underlying modern structural and focal seismology: the theory of elasticity with an application to the theory of waves, rheology and the fundamentals of the theory of destruction of materials. The sections of the discipline	5	✓	✓	✓		✓		

		include: modern methods for describing the mechanical properties of materials, techniques for solving dynamic problems of mechanics of elastic-viscous media, ideas about the physics of fracture and the theory of strength of heterogeneous materials, elements of tensor analysis, deformation and stress in a continuous medium								
7	Seismic waves in the earth's crust	The course examines the development of instrumental observations. Seismological observation systems. Sources of seismic vibrations. Seismic waves, their main characteristics, the speed of seismic waves. Ray theory of seismic wave propagation. The concept of a physical and mathematical ray. Seismic rays, beam parameter, wave front. Properties of seismic rays. Basic algorithms for calculating seismic ray paths. Inverse kinematic problem. The Gerglotz-Wichert equation. Ray trajectories and hodographs for a homogeneous layer lying on a half-space, etc.	5	✓	✓	✓				
8	Geophysical methods for studying the earth's crust	The discipline studies the physical and mathematical foundations of geophysical methods: electro-, gravity-, magneto-, seismic and geothermal exploration; principles of integration of geophysical, geochemical and geological methods of studying the subsurface; regional, deep, structural, prospecting and mapping geophysical research. Principles of paleomagnitology. Fundamentals of geological interpretation of gravitational and magnetic anomalies. Electrical models of the Earth's crust. Seismic wave velocities in the lithosphere and velocity models of large blocks of the lithosphere. Radio wave methods: tasks, methodology, results. Thermal models of the lithosphere.	5	✓	✓	✓	✓	✓		
9	Deep structure of the Earth's crust and lithosphere according to regional geophysical studies	The purpose of the course is to familiarize with the principles, tasks, methods and main results of regional geophysics. In the course of training, the tasks of regional geophysics will be considered: fundamental and applied, geodynamic and predictive. Structural	5	✓	✓		✓		✓	

		seismology and DSP: methods of structural seismology, deep seismic sounding. Electromagnetic sensing. Paleomagnitology. Regional gravimetry. Comprehensive interpretation of DSP and gravimetry data. Spherical physical model of the Earth..								
10	Project Management	The course studies the components of project management based on modern behavioral models of project-oriented business development management. The program is based on international standards PMI PMBOK, IPMA ICB and RK standards in the field of project management. The features of organizational management of business development through the interaction of strategic, project and operational management are studied.	5			✓	✓			✓
Cycle of special profile disciplines University component										
11	The basics of seismotectonics	The course is aimed at acquiring a system of knowledge about the nature of seismicity, both on a global and regional scale, as well as with the characteristics of geological structures that generate earthquakes. The focus will be on studying the features of geological structures that generate earthquakes; methods and techniques of seismotectonic studies; characteristics of earthquakes and their generating forces in the bowels of the Earth; features of the distribution of seismically active zones in the territories of the world and Kazakhstan.	5	✓		✓	✓	✓		
12	Geodynamic monitoring and forecasting of dangerous man-made processes	The development of the discipline is aimed at obtaining knowledge about the theoretical foundations of geodynamic monitoring, familiarization with the main provisions of the research methodology to obtain objective and optimal information for developing recommendations for optimizing the operation of the "engineering structure – geological environment" system; studying the methodology of monitoring the geological environment to solve the problem of	5	✓	✓		✓	✓		

		rational and environmentally safe human use of natural resources.								
13	Research practice	The objectives of the research practice are: - consolidation of skills of scientific or industrial work in seismology; collection of theoretical, laboratory and field material for writing a master's thesis; - formation of skills and abilities in the preparation of scientific and technical reports and public presentations; - 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: - direct participation in research or production work; - acquisition of professional competencies in accordance with the types and tasks of geological exploration; - involvement of a master's student in a scientific discussion in a creative team, development of public speaking skills; - mastering the technical means of presenting a scientific result. Forms of research practice: field, laboratory, desk. The content of a master's research practice depends on the focus of the task and the topic of the master's thesis. It is directly related to the nature and direction of the scientific activity of the organization in which the undergraduate is practicing. The research practice plan is drawn up individually for each undergraduate and is a program of theoretical, experimental or field work in the field of oil and gas or rune geophysics. This plan provides for: collection of seismological information on the object of research; analysis of data on the seismicity of the studied area; formulation and justification of specific research works; conducting field, experimental or computational work; processing and interpretation of the obtained materials.	4		✓		✓	✓	✓	✓

Cycle of special profile disciplines Component of choice										
14	Quantitative seismology	The course is based on the study of the deep structure of the Earth based on calculations of seismological characteristics. 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	✓	✓	✓	✓			
15	Engineering seismology fundamentals	The course is devoted to the basics of engineering seismology, the theory of seismic resistance and the dynamics of structures. The following issues are considered: existing methods for calculating reinforced concrete structures for seismic effects. Seismic standards of some developed countries. Forms of seismic destruction of buildings and structures after strong earthquakes, the real causes of seismic destruction of buildings. Theory and calculation of seismic resistance of buildings and structures based on the results of the strongest earthquakes. Features of the restoration and strengthening of buildings and structures damaged by earthquakes. Methodology for the technical and economic assessment of restoration work	5	✓	✓	✓		✓		
16	Seismic statistics	The course is aimed at obtaining knowledge and modern ideas about the statistical patterns of seismic statistics in the energy, spatial and temporal domains. Study of the Gutenberg-Richter law, Sadovsky hierarchy, fractal geometry of seismicity, temporal grouping of earthquakes. Particular attention is paid to the seismic cycle and the recurrence of earthquakes; the problem of comparing the results of seismic statistics with the conclusions of physical theories of	5	✓	✓		✓	✓		

		destruction. Problems of spatial-temporal connectivity and self-similarity of the seismic process, etc.								
17	Fundamental foundations of tectonosphere research	The course is devoted to the study of the tectonosphere by geophysical methods. General issues are considered: structure of the tectonosphere; oceanic and continental crust; suboceanic and subcontinental transitional types of the earth's crust; interaction of the lithosphere and asthenosphere. Geophysical methods of studying the tectonosphere. Magnetic exploration. Gravimetric method. Geothermal method. Magnetotelluric sounding. Seismic methods. Deep seismic sounding. Tectonic structure and connection of structures of different tectonic type, age of formation and history of development with structures of gravitational, magnetic, electric, thermal and seismic anomalous fields.	5	✓	✓	✓		✓		
18	Deep structure of the Earth according to seismological data	The course examines the fundamental laws of seismic wave propagation in the Earth. Types of seismic waves, their main characteristics. General ideas about the use of seismic waves in the study of the internal structure of the Earth. Seismic tomography. Methods of processing digital seismic data. Seismic recording equipment. The place of seismology in Earth sciences. Seismology and earthquake damage reduction. Seismic properties of soils. Seismological zoning and prediction of seismic impacts..	5	✓	✓	✓		✓		
19	Theoretical foundations, registration, processing and interpretation of seismic data	Studies the physical and geological foundations of seismic exploration; theory of elasticity; principles of geometric seismics; initial and boundary conditions; waves in absorbing media; types of real media; elastic waves in homogeneous media; basic principles of superposition; seismic models of the medium and seismic boundaries; seismic waves and hodographs in multilayer, gradient and layered-gradient media. The basics of digital registration of seismic signals are presented; telemetric seismic recording systems	5	✓		✓	✓	✓		✓

20	Software-processing complexes and technology of computer processing of seismology data	The course is designed to study modern technologies for digital processing of geophysical data, integrated systems for the interpretation of seismic geophysical measurements, and the information base of seismological methods. The principles and modern methods of analysis and mathematical processing of seismological information are studied. Attention is paid to the practical development of processing and interpretation programs. Modern processing computer systems, their functions, capabilities, technical characteristics are considered.	5			✓	✓			
21	The damage from the earthquake. Methods of assessment of the situation	The course discusses the scientific and methodological foundations for calculating earthquake damage and its consequences. Classification of buildings and structures. Calculation of the degree of damage to buildings and structures on the MSK-64 seismic scale. Forecasting of population losses in densely populated cities. Forecasting of damage and destruction of buildings, strengthening of administrative structures: kindergartens, schools, hospitals. Calculation of equipment and special medicines for emergency rescue operations after earthquake damage; organization of financing for restoration work.	5	✓	✓	✓	✓	✓		✓
22	Manmade seismicity	The course forms knowledge about the factors that determine technogenic seismic phenomena in the fields (groundwater, oil and gas, solid minerals), the possible consequences of strong technogenic earthquakes. Types of technogenic earthquakes and their causes are considered; seismic waves generated during earthquakes and recorded at seismic stations; methodological foundations and a schematic diagram of the analysis of seismological and seismotectonic materials for the assessment of man-made seismic hazard; the essence of the organization of geodynamic monitoring in the fields of solid minerals, oil and gas.	5	✓	✓		✓	✓		

23	Technogenic geophysical phenomena	The course is aimed at acquiring knowledge about the main elements of man-made geophysical phenomena and the factors determining them, to familiarize undergraduates with the possible consequences of strong man-made earthquakes. The study of man-made geophysical phenomena and possible consequences of strong man-made earthquakes, the factors determining the causes and nature of these phenomena, and their classification, the prevention of man-made disasters based on monitoring of their precursors.	5	✓		✓	✓	✓		
24	Technology of computer processing of seismic data	The course studies new approaches to improving the existing seismic service and creating new optimal and authorized production systems; collection, processing and storage of seismometric information. Transition from analog to digital information; creation of a flexible and reliable system with complex mathematical support; state of research and prospects for automation of seismometric studies; automated seismic analysis system; processing of instrumental observations; programs for determining the coordinates of epicenters.	5			✓	✓	✓		
25	Seismic regime	The course studies the following issues: seismic regime, as a set of earthquake sources, manifested in space, time and energy; aspects of seismicity and their use; assessment of the degree of seismic hazard of territories and forecast of the possibility of occurrence of strong earthquakes; studying the patterns of development of the seismic regime in the preparation of strong seismic events for the depth of earthquake sources, frequency, maximum possible energy and methods for studying the seismic regime on the law of earthquake frequency; determination of seismic regime parameters; methods for detecting anomalies in variations of seismic regime parameters caused by the local process of earthquake preparation..	5	✓	✓	✓	✓	✓		

26	Seismic regime and prediction of seismic hazard in Kazakhstan	The course forms knowledge on the calculation of seismic risks, preliminary assessment of the degree of damage to buildings and destruction of structures, population losses in densely populated cities during strong earthquakes, processing and interpretation of the information received on the degree of destruction of industrial and civil construction objects. The stages of work on the zoning of seismic hazard, the study of the seismic regime and the current level of seismicity of the territory, the allocation of seismically active regions and the assessment of their probable seismic potential are considered.	5	✓		✓	✓	✓		
27	Engineering seismology and seismic resistance	Engineering seismology is a branch of seismology that studies seismic data necessary for the design of stable (earthquake-resistant) structures against earthquakes. Mastering the basic concepts of engineering seismology. Assessment of the strength of earthquakes. The intensity of earthquakes. Equipment for registering earthquakes. Seismograms, velosigrams and accelerograms. Seismic zoning and micro-zoning. Identification of earthquake-prone areas and preliminary forecasts of the likely seismic impact of a strong earthquake, etc.	5	✓	✓	✓	✓	✓		
28	Information-measuring and software-processing complexes for modeling seismic events	The course studies information-measuring and software-processing complexes for determining the parameters of earthquakes. Considers the following issues: types of seismic stations for stationary and operational seismic observations; types of modern meters with different frequency ranges; digital registration systems. Determining the coordinates of hypocenters based on the analytical solution of the equations of direct waves. A method for quickly determining the position of the epicenter with a minimum of initial information and a group method. Software-processing complexes and examples of automatic computer determination of earthquake epicenters in Kazakhstan. Determination of the	5				✓	✓	✓	

		magnitude-energy characteristics of earthquakes on a computer								
29	Concepts and models of earthquake preparation	The discipline considers changes in the stress-strain state of the earth's crust caused by various physical and mechanical processes in rocks, up to their destruction, which are accompanied by tectonic earthquakes. Depending on the mechanisms and speeds of geodynamic processes, earthquakes are characterized by various models of their preparation and implementation: dilatant-diffuse (DD) model, avalanche-unstable cracking (LNT), stick-slip model: consolidation model, phase transformation model	5	✓		✓	✓	✓	✓	
30	Earthquake damage assessment methods	The course forms knowledge on determining the volume, nature and degree of destruction of objects and their elements (OE) during earthquakes; on the analysis of the impact of destruction and other negative impacts on the population and the sustainability of the functioning of the MA. Methods for assessing damage during earthquakes based on historical and modern seismic observations are being studied; methods for calculating the consequences of an earthquake and damage to administrative structures and residential buildings after earthquakes; methods for calculating the demographic and political consequences and means for carrying out work to eliminate emergencies.	5	✓	✓	✓	✓	✓		
31	Models and parameters of earthquake foci	The course examines the parameters and models of earthquake preparation at different levels of the Earth's lithosphere, its structure, patterns of deformation and destruction, the physics of the earthquake focus and structural-mechanical models of the environment. The issues of processing and interpreting the observed parameters of earthquake sources with the construction of modern geomechanical models, determining the parameters of earthquake sources, deformation processes in rock masses, physical laws	5	✓	✓			✓	✓	

		and conditions for the emergence of an unstable state of various geospheres of the Earth are studied.								
32	Modeling of geological environments	Geology, Geoinformation systems The discipline is aimed at preparing undergraduates to master the theoretical and methodological foundations of building three-dimensional digital geological models based on geophysical data to study modern natural and man-made geodynamic processes in the Earth's crust to ensure industrial and environmental safety. The discipline includes the study of the following issues: - methodology for creating an information database of geological, geophysical and geodetic materials, which became the basis for compiling a volumetric 5-layer 3D model (cube) of elastic-plastic parameters; - methodology of preparation of the tectonophysical and seismological basis of geodynamic zoning of the latest stage of development; -based on the obtained geodynamic models, the calculation of regional stresses and deformations and the assessment of seismicity.	4	✓		✓	✓	✓		
33	Monitoring of natural and man-made seismicity	The purpose of the course is to study a complex of works aimed at registration, processing and analysis of seismic signals of natural and man-made origin. In the course of training, the following will be considered: high-tech solutions in the field of hardware and software, methods of registering ground movement and methods of processing recorded information; interpretation of the results of studying natural and induced seismicity. Possible risks associated with the consequences of seismic impacts. Results of seismic monitoring, etc.	5	✓	✓	✓	✓			
34	Monitoring of the seismic hazard of the subsurface based on the study of geological processes	The course is designed to build three-dimensional geological and geophysical models of the geological environment and four-dimensional modeling of neotectonic processes that affect the formation of seismically hazardous zones. Monitoring objects: licensed subsoil plots; mining areas that affect the	4	✓	✓	✓	✓			

		development of hazardous geological processes. Types of subsoil condition monitoring: groundwater monitoring; monitoring of hazardous exogenous and endogenous geological processes; monitoring of mineral deposits by types of raw materials, etc. Methods of numerical modeling and mapping. Geological, geophysical, hydrogeological and engineering-geological characteristics of the monitoring of the seismic hazard of the subsoil.								
35	Physics and prediction of earthquakes	The course studies the physics of earthquake preparation and the phases of their prediction algorithms: long-term, medium-term and short-term. The following questions are considered: seismic, deformation, electromagnetic, geochemical and other precursors; the nature and concept of the source of earthquakes and models of a seismic source; physical parameters of earthquakes; energy, geometric and dynamic characteristics of the earthquake source; errors and uncertainties in estimates. Goals, tasks and types of earthquake prediction, physical prerequisites for earthquake prediction. Identification of the stages of earthquake preparation.	5	✓	✓	✓	✓	✓		✓
36	Harbingers of earthquakes	The course examines the patterns and physical nature, parameters and methods for identifying tectonic and geophysical precursors; the use of these precursors to develop a strategy for predicting earthquakes in terms of their duration and spatial localization in assessing seismic hazard and seismic risk. The following questions are considered: statistical and physical aspects of tectonic and geophysical precursors of earthquakes; methods for detecting anomalies in variations in the parameters of geophysical fields and anomalies in tectonic tension caused by the process of earthquake preparation. Forecast of tectonic earthquakes, application of various algorithms for earthquake forecasts.	5	✓	✓	✓	✓			

37	Zoning of seismic risks and preliminary assessment of the impact of strong earthquakes	The course forms knowledge about seismic risk calculation, preliminary assessment of the degree of damage to buildings and structures, death of settlements in cities with high density during strong earthquakes, processing and interpretation. The stages of work on the zoning of seismic hazard, the study of the seismic regime and the current level of seismicity, the identification of seismically active regions with an assessment of their seismic potential are considered.	5	✓	✓	✓	✓	✓		
38	Seismological monitoring of underground nuclear and industrial explosions. Technogenic geophysical phenomena.	The discipline studies the system of scientific knowledge and research methods in the field of underground nuclear and industrial explosions to ensure seismic safety in the mining industry. The following questions are considered: methodology of seismological monitoring of underground nuclear and industrial explosions, methods of their detection and recognition; factors determining technogenic seismic impacts and possible consequences of strong technogenic earthquakes; the main elements of technogenic geophysical phenomena and their determining factors. seismic waves recorded at seismic stations during man-made earthquakes; methodology for the analysis of seismological and seismotectonic materials for the assessment of man-made seismic hazard	5	✓		✓	✓	✓		✓
39	Geodynamic monitoring and forecasting of dangerous man-made processes	The development of the discipline is aimed at obtaining knowledge about the theoretical foundations of geodynamic monitoring, familiarization with the main provisions of the research methodology to obtain objective and optimal information for developing recommendations for optimizing the operation of the "engineering structure – geological environment" system; studying the methodology of monitoring the geological environment to solve the problem of rational and environmentally safe human use of natural resources.	5	✓	✓			✓	✓	

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

SATBAYEV UNIVERSITY

APPROVED
Chairman of the Management Board-
Rector of Kazakh National Research Technical University named after K.I. Satpayev
M.Zh. Begentaev
"07" 07 2023 y.

CURRICULUM
of Educational Program on enrollment for 2023-2024 academic year

Educational program 7M05302 - "Seismology"
Group of educational programs M091 - "Seismology"

Form of study: full-time **Duration of study: 2 year** **Academic degree:Master of Technical Sciences**

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			
								1 course		2 course	
								1 semester	2 semester	3 semester	4 semester
CYCLE OF BASIC DISCIPLINES (BD)											
M-1. Module of basic training (university component)											
LNG210	English (professional)	BD UC	5	150	0/0/3	105	E	5			
HUM214	Management Psychology	BD UC	3	90	1/0/1	60	E		3		
HUM212	History and philosophy of science	BD UC	3	90	1/0/1	60	E		3		
HUM213	Higher school pedagogy	BD UC	3	90	1/0/1	60	E	3			
M-2. Module of special seismological 1											
GPH261	Fundamentals of seismology	BD CCH	5	150	2/0/1	105	E	5			
GPH749	Fundamentals of engineering seismology										
GPH286	Geophysical methods of studying the Earth's crust	BD CCH	5	150	2/0/1	105	E	5			
GPH 762	Fundamental foundations of tectonosphere research										
GPH700	The deep structure of the Earth's crust and lithosphere according to regional geophysical studies										
GPH750	Quantitative seismology	BD CCH	5	150	2/0/1	105	E			5	
GPH751	Seismic statistics										
MNG704	Project management										
CYCLE OF PROFILE DISCIPLINES (PD)											
M-3. Module of special seismological 2											
GPH285	Fundamentals of seismotectonics	PD UC	5	150	2/0/1	105	E	5			
GPH761	Concepts and models for preparing land plots	PD CCH	5	150	2/0/1	105	E	5			
GPH713	Models and parameters of earthquake foci										
GPH753	Seismic waves in the Earth's crust	BD CCH	5	150	2/0/1	105	E		5		
GPH754	Deep structure of the Earth according to seismological data										
GPH755	Theoretical foundations, registration, processing and interpretation of seismic data										
GPH288	Technology of computer processing of seismological data and software processing complexes	PD CCH	5	150	2/0/1	105	E			5	
GPH269	Technology of computer processing of seismic data										
GPH 763	Information-measuring and software-processing complexes for modeling seismic events										
GPH275	Damage caused by earthquakes. Methods for assessing the situation	PD CCH	5	150	2/0/1	105	E			5	
GPH720	Man-made seismicity										
GPH242	Man-made geophysical phenomena										
GPH289	Seismic regime	PD CCH	5	150	2/0/1	105	E		5		
GPH703	Seismic regime and seismic hazard forecasting in Kazakhstan										
GPH714	Engineering seismology and seismic resistance	PD CCH	5	150	2/0/1	105	E		5		
GPH718	Zoning of seismic risks and preliminary assessment of the impact of strong earthquakes										
GPH287	Earthquake physics and forecast	PD CCH	5	150	2/0/1	105	E			5	
GPH722	Earthquake precursors										
GPH721	Earthquake damage assessment methods										
GPH267	Seismic monitoring of underground nuclear and industrial explosions	PD CCH	5	150	2/0/1	105	E			5	
GPH723	Geodynamic monitoring and forecasting of hazardous man-made processes										
GPH724	Monitoring of natural and man-made seismicity										
GPH759	Modeling of geological environments	PD CCH	4	120	2/0/1	75	E			4	
GPH760	Monitoring of subsurface seismic hazard based on the study of geological processes										

M-4. Practice-oriented module											
AAP229	Pedagogical practice	BD UC	6						6		
AAP256	Research practice	PD, CCH	4								4
M-5. Experimental research module											
AAP251	Research work of a master's student, including internship and completion of a master's thesis	RWMS UC	2					2			
AAP241	Research work of a master's student, including internship and completion of a master's thesis	RWMS UC	3						3		
AAP254	Research work of a master's student, including internship and completion of a master's thesis	RWMS UC	5							5	
AAP255	Research work of a master's student, including internship and completion of a master's thesis	RWMS UC	14								14
M-6. Module of final attestation											
ECA205	Preparation and defense of a master's thesis	FA	8								8
	Total based on UNIVERSITY:							30	30	34	26
								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	15	35
PD	Cycle of profile disciplines		9	44	53
	Total for theoretical training:	***0***	***29***	***59***	***88***
	RWMS				***24***
FA	Final attestation	8			8
	TOTAL:	**8**	**29**	**59**	**120**

Decision of the Academic Council of Kaznu named after K.Satpayev. Protocol №3 "27". 10. 2022 y.

Decision of the Educational and Methodological Council of Kaznu named after K.Satpayev. Protocol №2 "21" . 10. 2022 y.

Decision of the Academic Council of the Institute_____. Protocol №2 от "14" 10 2022 y.

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

Institute Director **A.H. Syzdykov**

Department Head Geophysics **B.T. Ratov**

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