K.Turysov Institute of Geology and Oil and Gas Engineering
Department of "Geophysics and Seismology "

EDUCATIONAL PROGRAM
6B05208 –«Seismology»

Code and classification of the field of education: 6B05 – Natural Sciences, Mathematics and Statistics

Code and classification of training areas: 6B052 – Environment

Group of educational programs: B052 – Earth Science

Level based on NQF: 6

Level based on IQF: 6

Duration of study: 4 years

Volume of credits: 240

Almaty 2025

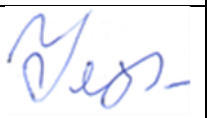
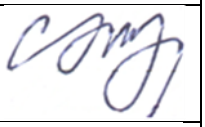
Educational program 6B05208 – «Seismology» was approved at a meeting of of NJSC "Kazakh National Research Technical University named after K.I.Satpayev" Academic Council

Protocol №10 "06". 03. 2025 y.

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

Protocol №3 "20".12. 2024 y.

The educational program 6B05208 – "Seismology" was developed by the academic committee in the field of training 6B052 – "Environment"

Full name	Academic degree/academic title	Position	Workplace	Signature
Chairman of the Academic Committee:				
Istekova Sara amanzholovna	Doctor of Geological and Mineralogical Sciences	Professor	NJSC "Kazakh National Research Technical University named after K.I.Satpayev"	
Teaching staff:				
Boranbai Tovbasarovich Ratov	Doctor of Technical Sciences, Professor	Head of the Department of Geophysics and Seismology	Kazakh National Research Technical University named after K.I.Satpayev	
Abetov Auez Egemberdievich	Doctor of Geological and Mineralogical Sciences	Professor	Kazakh National Research Technical University named after K.I.Satpayev	
Umirova Gulzada Kubashevna	Doctor of PhD	Associate Professor	Kazakh National Research Technical University named after K.I.Satpayev	
Temirkhanova Raushan Galimzhanovna	Doctor of PhD	Associate Professor	Kazakh National Research Technical University named after K.I.Satpayev	
Siylkhanova Akkenje Orishanovna	Doctor of PhD	Senior Teacher	Kazakh National Research Technical University named after K.I.Satpayev	
Aliakbar Madiyar Manarbekuly	Master of Technical Sciences	Senior Teacher	Kazakh National Research Technical University named after K.I.Satpayev	
Employers:				
Mikhailova Natalia Nikolaevna	Doctor of Physical and Mathematical Sciences	Director	Kazakhstan National Data Center (KNDC)	

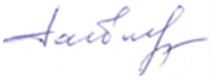
Uzbeks Nursarsen Bolataevich	Candidate of Physical and Mathematical Sciences	Deputy Director of Science	Institute of Seismology	
Students				
Dosymbekova Zhansaya	Master of Technical Sciences	Doctoral student 2 years of study	Institute of Seismology	
Isagali Asem	Master of Technical Sciences	Doctoral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

Table of contents

List of abbreviations and designations

EP – educational program;
NJSC «KazNITU named after K.I.Satpayev» – Non-profit Joint Stock Company «Kazakh National Research Technical University named after K.I. Satpayev»;
GOSO – The State compulsory standard of education of the Republic of Kazakhstan;
Ministry of Education and Science of the Republic of Kazakhstan – Ministry of Education and Science of the Republic of Kazakhstan;
UMO – Educational and methodical Department;
ICT – information and communication technologies;
NQF – National Qualifications Framework;
U – universal, social and ethical competencies
OQF – Industry Qualifications Framework;
PC – professional competencies;
LO – learning outcomes of the educational program;
S – special and managerial competencies.
JSC is a joint–stock company;
LLP is a limited liability partnership.
CT - competence training;
BD- basic discipline;
PD- profile discipline;
UC- University component;
CC-Component of choice;
FA- final assessment;
SRO (SRS, SRM, SRD) – independent work of the student;
SROP (SRSP, SRMP, SRDP) – independent work of a student with a teacher;
RUP – working curriculum;
IUP – individual curriculum.

1. Description of the educational program

The Bachelor's degree program 6B05208 – "Seismology" was developed within the framework of the training area 6B052 – "Environment" is aimed at students acquiring basic theoretical knowledge and practical skills in the field of fundamental research of the Earth's crust, methodologies and methods for conducting, processing and interpreting the data obtained, instrumentation for seismological research aimed at studying the propagation of seismic waves in the bowels of the Earth, earthquakes and related phenomena, as well as making long-term forecasts of foci their occurrence, strength, and repeatability.

Bachelor's degree program in the field of 6B05208- " Seismology" provides: a) training of specialists in the field of fundamental research of the Earth's crust and seismological surveys; b) obtaining by students high-quality knowledge about the internal structure of the Earth, its origin and evolution in terms of basic geological processes, physical properties of rocks and geophysical fields for use in studying the seismicity of the Earth; c) obtaining by bachelors knowledge and modern ideas about earthquakes and related phenomena, types of earthquakes and their causes; seismic waves excited during earthquakes and recorded at seismic stations; ideas about the earthquake source and the physics of the processes occurring in it, about the parameters of earthquakes; d) acquisition by students of a set of knowledge on the theoretical study of the principles of seismic monitoring as part of safety systems for critical structures and industrial work areas, as well as technology for multipara meter monitoring of seismic activity by a complex of geological and geophysical methods and the formation of appropriate professional ideas and skills among students; e) students' knowledge of equipment and standard software for information and measuring systems of seismic monitoring; f) acquisition of skills in analyzing seismological data, structuring them, methods for constructing effective graphs and graph plans, maps of isolines of the distribution of seismic field parameters.

The program includes training in modern computer programs "Antelope" BRTT (USA), "Seascomp" GEMPA (German), "ApolloServer" Nanometrics (Canada), "InSite" ASC (UK), Surfer, etc.

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

3rd year bachelors studying in the seismological field and having high academic performance can study under the additional Minor educational program. This is a set of disciplines and (or) modules and other types of educational work determined by the student for study (Rules for organizing the educational process on credit technology of education Order No. 75 of the Minister of Education of the Republic of Kazakhstan dated March 28, 2023) in order to obtain professional competencies determined directly by the Customer (Institute of Seismology, Kazakhstan National Data Center (KNDC).

Students undergo an educational geophysical internship at their own training ground in Kapshagai.

The production practice will be conducted at research institutes (Institute of Seismology of the Ministry of Education and Science of the Republic of

Kazakhstan), the Kazakhstan National Data Center (KNDC), the Ministry of Emergency Situations of the Republic of Kazakhstan "NSCSNI" LLP (National Scientific Center for Seismological Research and Observations), the Central Seismic Observatory "Almaty" (CSO "Almaty"), the International Center for Seismic Information of the Russian Academy of Sciences (Obninsk, Russia), Experimental and Methodological Seismological Expedition of the Academy of Sciences of Kyrgyzstan; Institute of Earth Physics of the Russian Academy of Sciences; Complex experimental and methodological expedition of the Institute of Seismology of Uzbekistan; Seismological Bureau "XUAR" of the People's Republic of China and IGI of the National Research Center of the Republic of Kazakhstan. and others.

The best students can get additional education through the academic mobility program at universities around the world.

Graduates receive a Bachelor of Science degree and can work in research institutes, in seismological companies in engineering and technical positions.

The positive aspects of the profession within the framework of the seismological specialty include the following: Seismologists contribute to science by studying Earth processes and providing important data for understanding the structure of the Earth; work in this field provides continuous professional development and the opportunity to participate in large-scale scientific research; seismological data helps to build more stable buildings and infrastructure, contributing to earthquake safety; the opportunity to work in the best foreign companies in which The field of seismology is developed, for example, in Japan.

The field of professional activity:

The field of professional activity of the bachelor includes a set of technologies, tools, methods and methods aimed at studying processes in the bowels of the Earth, obtaining knowledge and modern ideas about earthquakes and related phenomena, types of earthquakes and their causes; seismic waves excited by earthquakes and recorded at seismic stations; ideas about the earthquake source and the physics of the processes occurring in it, about the parameters of earthquakes. The essence of the key role of seismologists is to ensure safety, resource base and scientific research related to seismic activity.

Objects of professional activity:

Tectonic structures and zones that are sources of seismic activity, natural resources, oil and gas deposits, deposits of solid minerals, forecasting, monitoring and management of risks associated with earthquakes, including man-made ones, mining, physical fields in rocks as a source of measuring information for seismological surveys, mathematical and physical models of formations, sections, mineral deposits in the process of their exploration and development; geophysical computerized and software-controlled information measuring and processing systems and complexes; theoretical and physical models for their design and operation.

The subjects of professional activity are:

Studying the structure of the Earth's crust, its physical models and physical properties of rocks; conducting scientific research in the field of seismological observations; conducting field observations, processing, interpretation and modeling of the data obtained in the study of seismic activity of the geological environment, as well as

measures aimed at reducing the risks of seismic events and protecting the population and infrastructure.

The fields of professional activity of the bachelor are:

- scientific institutes and laboratories where fundamental scientific research on the study of earthquakes and other seismic phenomena is carried out;
- Academic and departmental research organizations involved in solving earthquake-related problems;
- Government agencies responsible for monitoring seismic activity and developing a civil protection strategy;
- service and operator companies related to the oil and gas and ore industries. In this industry, seismology is used to explore the earth's interior, identify mineral deposits and plan drilling;
- engineering companies where seismologists provide expertise in the field of engineering projects to ensure the safety of structures;
- meteorological and seismological services related to forecasting and monitoring of natural phenomena;
- the construction industry to analyze the seismic potential in the construction areas and develop appropriate safety measures;
- institutions of higher and secondary specialized education.

Types of professional activity:

Graduates of the bachelor's degree in the field of Seismology, in accordance with their professional training, can perform the following types of activities:

Organizational and managerial:

- planning and organization of seismological work both in earthquake-prone areas and in non-seismic areas;
- development of operational work plans for seismological parties and detachments;
- selection and justification of scientific, technical and organizational solutions based on geological and geophysical data and economic calculations.

Production and technological:

- organization of the production process during field and seismological research;
- ensuring compliance of these studies with design estimates, technical requirements and safety rules;
- selection of methods, equipment and installations for performing seismological studies;
- effective use of methods and technical means, equipment, algorithms and programs for the selection and calculation of parameters of seismological research.

Experimental research:

- collection and systematization of scientific and technical information of domestic and international experience in relation to solving problems of seismology;
- numerical modeling of objects of seismological research based on modern software;
- planning and conducting experimental and methodological seismological work;

- regulation and adjustment of seismological equipment and instrumentation;
- registration of various seismological parameters. Ensuring the quality of the receiving signals;
- quality control of the performed seismological surveys.

Calculation, design and analytical:

- formation of the goals and objectives of the project (program), providing a modern level of seismological research;
- registration of technological documentation for geophysical research;
- collection and analysis of information source data for design;
- conducting a preliminary feasibility study of design calculations;
- development of design and estimate documentation for the implementation of seismological studies;
- implementation of projects in production and author's supervision.
- participation in the assessment of the economic efficiency of the production activities of personnel of seismological parties and detachments;
- ensuring the safety of conducting seismological work.

2. The purpose and objectives of the educational program

The Department of Geophysics and Seismology conducts educational activities in the field of bachelor's degree trajectory 6B05208 – "Seismology".

The department plans to prepare bachelors in seismology of a wide profile for professional activity in the following theoretical and applied areas:

- prospecting and exploration of mineral deposits;
- fundamental research of the Earth's lithosphere;
- in-depth study of the theoretical foundations of seismological methods;
- study of the principles of obtaining and processing field seismological data, their geological interpretation and modeling;
- integration of seismological methods in solving seismological problems.

The goals and objectives of the presented educational program are formulated taking into account the requirements and requests of potential consumers, as well as based on the assessment of the relevance of this educational program, which is determined by the interests of potential employers, students, the potential of the university, the requirements of the state and society as a whole.

The purpose of the EP: Training of professionally educated and competent seismologists for research institutes, operators (subsoil users) and service companies, capable of effectively participating in studies of the structure of the earth's crust and working in engineering and technical positions to study the propagation of seismic waves in the bowels of the Earth, earthquakes and related phenomena, as well as to compile long-term forecasts of earthquake sources, their occurrence, strength and recurrence, taking into account environmental, social and economic aspects aimed at minimizing the impact on the environment and improving public safety

Tasks of the EP:

- obtaining social competencies based on the study of a cycle of socio-humanitarian disciplines in order to form readiness for the socio-professional life of

a seismologist with a high degree of preparedness, skills, skills, with social and value norms that will allow productive interaction with the professional and social environment, to be responsible for their social well-being;

- obtaining the foundation of professional education based on natural science, general technical and economic knowledge of the cycle of basic disciplines;
- the study of a cycle of core disciplines focused on the study of key theoretical and practical aspects of the technique and technology of conducting seismological research in order to rationally prevent the occurrence of seismic events;
- familiarization with the methods, technologies and equipment of state, operator and service services and companies during the period of production practices (first and second);
- preparation of bachelors for the collection of materials from previous years (results of seismotectonic, paleoseismological, engineering-geological, geological-geophysical and geodetic works) for the preparation of observation points and the placement of seismological stations;
- acquisition of skills and abilities to prepare raw materials and equipment for seismological observations under the guidance of a specialist seismologist;
- multi-aspect training of bachelors in conducting field practical exercises on conducting auxiliary operations when checking and configuring stationary equipment (telemetry recording stations and equipment), taking into account the specific conditions for recording a seismic signal, including obtaining, processing and interpreting seismological data, building graphs, maps and diagrams;
- training of competitive specialists in demand in the labor market, possessing a set of necessary knowledge and skills, including: a) to carry out the necessary operations when registering a seismic signal over a local observation network; b) to record recorded events in a long-term storage device; c) to comply with labor protection, safety and environmental protection, fire protection requirements when conducting seismological studies under the guidance of a seismologist.

3. Requirements for evaluating the educational program learning outcomes

The graduate of this educational program is awarded the academic degree of Bachelor of Engineering and Technology.

- A graduate of the Department of Geophysics and Seismology in the Bachelor's degree program "Seismology" should know:
- goals and objectives of seismology in the system of Earth sciences;
- be aware of the social significance of your future profession;
- have a high motivation to perform professional activities;
- be able to evaluate the possibilities of seismology methods and navigate the conditions of applicability of seismological surveys;
- have the skills to work with seismological equipment and seismological data, as well as have the skills to work with a computer as a means of information management.

Demonstrate the ability to work as part of a research team, participate in the preparation of reports, abstracts, bibliographies on the subject of scientific research,

in the preparation of publications; willingness to work with seismological data, field and laboratory seismological instruments, installations and equipment (seismic stations, seismic receivers, auxiliary devices, seismometers, accelerometers, etc.

To apply in practice methods of collection, processing, analysis and generalization of stock, field and laboratory geological and geophysical information; to participate in the organization of scientific and practical seminars and conferences.

The volume of the bachelor's degree program (OP) is 240 credits, regardless of the form of study, the educational technologies used, the implementation of the bachelor's program using the online form, the implementation of the bachelor's program according to an individual curriculum, including accelerated learning.

The content of the OP "Seismology" is formed on the basis of the development of a multi-level training system, the fundamental nature and quality of education, continuity and continuity of education and science, unity of education, upbringing, research and innovation activities aimed at maximum satisfaction of consumer needs should ensure:

- obtaining a full-fledged and high-quality professional education in the field of seismology, confirmed by the level of knowledge and skills, skills and competencies, based on criteria established by the State Educational Standard, their assessment, both in content and in volume;

- preparation of bachelors for the seismological and mining industries who know the technology and methods of conducting seismological work, methods of processing, interpretation and modeling of the obtained seismological data;

-training of professional and competitive specialists in the field of seismology who are able to apply innovative methods in the study of the structure of the Earth's crust and work in engineering positions in the study of the propagation of seismic waves in the bowels of the Earth, earthquakes and related phenomena, as well as in the preparation of a long-term forecast of earthquake foci, their occurrence, strength and repeatability, search and exploration of mineral deposits;

- application of knowledge of fundamental and technical sciences, including mathematics, physics, chemistry;

- the use of methods of system analysis in evaluating the obtained seismological data;

- knowledge of modern problems of seismology;

- acquisition of practical skills in working with seismological equipment, modern software for processing, interpretation and modeling of obtained seismological data using modern information technologies;

- the use of methods, skills and modern technical means necessary in the study of the propagation of seismic waves in the bowels of the Earth, earthquakes and related phenomena, as well as in making a long-term forecast of earthquake foci, their occurrence, strength and repeatability, identification and prospecting of oil and gas prospective objects and deposits of solid minerals;

- the ability to work with the necessary, updated literature, computer information, databases and other sources of information to solve tasks;

- formation of students' skills to work in a team, but at the same time to show individuality, and, if necessary, solve problems independently;

- formation of bachelors' industrial and ethical responsibility, the ability to understand the problem from working together with various specialists, to find optimal solutions, the need to improve their knowledge and skills;

- the readiness of bachelors for professional activity through disciplines that provide fundamental knowledge, skills and work skills in production, government organizations and services, research institutes and educational institutions;

- the ability to analyze seismological data and monitor seismological work, as well as to make management decisions based on their results when organizing and conducting seismological observations and primary processing of recorded data;

- have erudition, knowledge of modern social and political problems, speak the state, Russian and foreign languages, tools of the market economy, safety and environmental issues

4. Passport of the educational program

4.1. General information

Table 1 - Passport of the educational program

№	Field name	Comments
1	Code and classification of the field of education	6B05 – Natural Sciences, Mathematics and Statistics
2	Code and classification of training directions	6B052 – Environment
3	Educational program group	B052 – Earth Science
4	Educational program name	6B05208 - Seismology
5	Short description of educational program	It is intended for the implementation of specialized bachelor's degree training in the educational program of the specialty "Seismology" Satbayev University. The Bachelor's degree program in the field of Seismology provides: a) training of specialists in the field of seismology and prospecting and exploration of mineral deposits; b) obtaining by bachelors of high-quality knowledge on the staging and conduct of seismological surveys, organization and conduct of field seismological measurements, processing, interpretation and modeling of the data obtained; c) acquisition of skills in analyzing geological and geophysical data, their structuring, classifications of target objects on mineral deposits; formulation and solution of direct and inverse problems in the search and exploration of mineral deposits; analysis of seismological data, construction of necessary graphs, diagrams and maps for the prediction and assessment of earthquakes.
6	The purpose of the educational program	Training of professionally educated and competent seismologists for research institutes, operators (subsoil users) and service companies, capable of effectively participating in studies of the structure of the earth's crust and working in engineering and technical positions to study the propagation of seismic waves in the bowels of the Earth, earthquakes and related phenomena, as well as to compile long-term forecasts of earthquake sources, their

		occurrence, strength and recurrence, taking into account environmental, social and economic aspects aimed at minimizing the impact on the environment and improving public safety
7	Type of EP	New
8	The level based on NQF	6
9	The level based on IQF	6
10	Distinctive features of the EP	no
11	List of competencies of the educational program	**General cultural competencies (GC):** GC 1 The ability to communicate orally and in writing in the state, Russian and foreign languages to solve problems of interpersonal and intercultural interaction; GC 2 Understanding and practical use of healthy lifestyle norms, including prevention issues, the ability to use physical culture to optimize performance GC 3 Ability to analyze the main stages and patterns of the historical development of society for the formation of a civic position GC 4 Ability to use the basics of philosophical knowledge to form a worldview position GC 5 Ability to critically use the methods of modern science in practice GC 6 Awareness of the need and acquisition of the ability to independently study and improve their skills throughout their work GC 7 The meaning and understanding of professional ethical standards, mastery of professional communication techniques GC 8 Ability to work in a team, tolerantly perceiving social, ethical, confessional and cultural differences GC 9 The ability to use the basics of economic knowledge in various fields of activity. **General professional competencies (GIC):** GIC 1 The ability to independently acquire new knowledge using modern educational and information technologies GIC 2 Possession of computer skills sufficient for professional activity and knowledge of professional programs GIC 3 Knowledge of the basic methods, methods and means of obtaining, storing, processing information, the ability to use modern technical means and information technologies to solve general professional tasks GIC 4 Understanding of the essence and knowledge of information in the development of modern society, the ability to receive and process information from various sources, willingness to interpret, structure and formalize information in a form accessible to others **Professional Competencies (PC):** PC 1 The ability to systematically study scientific and technical information, domestic and foreign experience in the seismological profile of training PC 2 The ability to integrate applied sections of

		seismology and specialized geological and geophysical knowledge (including physical processes occurring in the Earth) to solve problems of seismology, geology and geophysics; PC 3 The ability to participate in work on innovative projects using basic research methods. Mastering the skills of systematic logical thinking in the analysis of scientific data and setting practical tasks for geophysical research; PC 4 The ability to review, analyze and summarize geological and geophysical information to select the main parameters of field seismological survey, conduct experimental and methodological work and optimize the methodology of seismological observations; PC 5 is the ability to independently set specific tasks of seismology and solve them based on the use of modern equipment, software and information technologies using the latest domestic and foreign experience; PC 6 The ability to manage scientific and industrial work in solving complex problems of seismology, at the stages of design, execution (including processing, analysis and interpretation) and preparation of reports to present the results; PC 7 Proficiency in professional operation of modern seismological field equipment; determination of technical and technological parameters of equipment, equipment, materials and preparation of equipment for field work (setup, verification or testing, preventive maintenance); PC 8 Skills in organizing and conducting seismological observations and primary processing of recorded data; PC 9 The ability to carry out metrological measures for the preparation of equipment, facilities and installations with an acceptable error. Calibration and standardization of seismological equipment designed to solve seismological problems. Skills in organizing and conducting high-quality processing for linking and joint geological interpretation of the results of previous stages of processing geophysical and petrophysical data. Organization of registration of processing results and their transfer to the customer; PC 10 Possession of computer software packages designed to work with a complex of seismological data ("Antelope" BRTT (USA), "Seascomp" GEMPA (German), "ApolloServer" Nanometrics (Canada), "InSite" ASC (UK), Surfer, etc.). PC 11 Ability to analyze and apply when the laws on subsoil and subsurface use, industrial safety and environmental code, state seismological expertise, regularly monitor changes and additions to these legal norms and laws; PC 12 is the ability to identify and systematize the main ideas in scientific publications; critically evaluate the effectiveness of various approaches to

		solving problems of seismology; formulate an independent view of the proposed problem, taking into account the latest domestic and foreign experience and knowledge of the main directions of development and problems of seismology, the current level of elaboration of problems and the most promising areas of development.
12	Learning outcomes of the educational program:	LO1. Demonstrate the ability to engage in professional interpersonal communication in Kazakh, Russian, and English languages when addressing issues related to seismic hazards LO2. Utilize economic, environmental, social, political, and ethical foundations, as well as healthy lifestyle norms, to develop the professional, ethical, cultural, and psychological qualities of a seismologist LO 3. Demonstrate theoretical and practical knowledge in the fields of physical, mathematical, and natural sciences, as well as information and computer technologies, to solve seismological problems LO 4. Critically evaluate and use the foundations of philosophy and the historical development of society to form a civic and worldview position LO 5. Apply scientific research methods to solve tasks set in innovative seismological projects, critically utilizing modern scientific methods in practical activities LO6. Analyze and apply legal norms and laws on subsoil and subsoil use in the implementation of entrepreneurial activities, taking into account the principles of industrial safety, environmental protection and compliance with environmental standards aimed at sustainable management of natural resources and minimizing the negative impact on ecosystems and communities LO 7. Utilize comprehensive economic, entrepreneurial, and environmental knowledge, considering the basics of life safety and anti-corruption culture LO8. Demonstrate and apply knowledge of the basics of seismology, the theory of seismic wave propagation, the structure of the Earth, sources of earthquakes, and methods of their registration LO 9. Professionally operate modern seismological equipment and prepare instruments for fieldwork, conduct field seismic observations, and carry out the installation and maintenance of seismic stations LO 10. Apply methods of collecting, processing, and interpreting seismic data to solve problems of seismic hazard and risk assessment, and develop measures to reduce earthquake damage LO 11. Use modern software tools and information technologies to analyze seismic data and construct models of seismic activity LO12. Organize research activities in the field of seismology, including setting tasks, developing research methodologies, and analyzing the results

		obtained
13	Form of training	full - time
14	Duration of training	4
15	Volume of loans	240
16	Languages of instruction	Russian/Kazakh
17	Academic degree awarded	Bachelor of Science in Natural Sciences
18	Developer(s) and authors:	1) Professor Abetov A.E., 2) Associate Professor Umirova G.K. 3) teacher Muzapparova A.B.

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

Table 2 - Results of training in the educational program 6B05208 - "Seismology"

№	Name of the discipline	A brief description of the discipline	Number of credits	Generated learning outcomes (codes)											
				LO1	LO2	LO3	LO4	LO5	LO6	LO7	LO8	LO9	LO10	LO11	LO12
Cycle of general education disciplines Required component															
1	History of Kazakhstan	The purpose of the discipline is to provide objective historical knowledge about the main stages of the history of Kazakhstan from ancient times to the present day; introduce students to the problems of the formation and development of statehood and historical and cultural processes; contribute to the formation of humanistic values and patriotic feelings in the student; teach the student to use the acquired historical knowledge in educational, professional and everyday life; evaluate the role of Kazakhstan in world history.	5	V	V	V									
2	Philosophy	The purpose of the discipline is to teach students the theoretical foundations of philosophy as a way of knowing and spiritually mastering the world; developing their interest in fundamental knowledge, stimulating the need for philosophical assessments of historical events and facts of reality, assimilating the idea of the unity of the world historical and cultural process while recognizing the diversity of their skills in applying philosophical and general scientific methods in professional activities.	5	V	V	V									
3	English language	English is a compulsary subject. According to the results of placement test or IELTS score, students are placed into groups and disciplines. The name of the discipline corresponds to the level of English. When passing from level to level, prerequisites and postrequisites are respected.	10			V								V	V
4	Kazakh (Russian) language	In this course author considers socio-political, socio-cultural spheres of communication and functional styles of the modern kazakh (russian) language. The course covers the specifics of the scientific style to develop and activate professional communication skills and abilities of students. Also it allows students to leavn the basics of scientific style practically and develop the ability of production structural and semantic text analysis.	10			V								V	V

5	Information and communication technology	The aim of the course is to gain theoretical knowledge in information processing, the latest information technologies, local and global networks, the methods of information protection; Getting the right use of text editor editors and tabulators; creation of base and different categories of applications.	5			V								V	V
6	Module of socio-political knowledge (sociology, political science)	The objectives of the disciplines are to provide students with explanations on the sociological analysis of society, about social communities and personality, factors and patterns of social development, forms of interaction, types and directions of social processes, forms of regulation of social behavior, as well as primary political knowledge that will serve as a theoretical basis for understanding social -political processes, for the formation of political culture, development of a personal position and a clearer understanding of the extent of one's responsibility; help to master the political, legal, moral, ethical and socio-cultural norms necessary to act in the interests of society, form personal responsibility and achieve personal success.	3	V	V	V	V								
7	Module of socio-political knowledge (cultural studies, psychology)	The purpose of the disciplines is to study the real processes of cultural creative activity of people who create material and spiritual values, identify the main trends and patterns of cultural development, changes in cultural eras, methods and styles, their role in the formation of man and the development of society, as well as master psychological knowledge for the effective organization of interpersonal interaction, social adaptation in the field of their professional activities.	5	V	V	V	V			V					
8	Physical Culture	The purpose of the discipline is to master the forms and methods of forming a healthy lifestyle within the framework of the professional education system. Familiarization with the natural-scientific basics of physical education, knowledge of modern health-improving technologies, basic methods of independent physical education and sports. As part of the course, the student will master the rules of judging in all sports.	8		V		V								
Cycle of general education disciplines The university component															
9	Fundamentals of anti-corruption culture and law	Purpose: to increase the public and individual legal awareness and legal culture of students, as well as the formation of a knowledge system and a civic position on combating corruption as an antisocial phenomenon. Contents: improvement of socio-economic relations of the Kazakh society, psychological features of corrupt behavior,	5		V					V	V				

		formation of an anti-corruption culture, legal responsibility for acts of corruption in various fields.													
10	Fundamentals of scientific research methods	Purpose: The goal of studying the discipline is to develop students' research skills; to introduce students to scientific knowledge, their readiness and ability to conduct research. Objectives of studying the discipline: to contribute to the deepening and consolidation of existing theoretical knowledge by students; to develop practical skills in conducting scientific research, analyzing the results obtained and developing recommendations; to improve methodological skills in independent work with information sources and appropriate software and hardware.		V			V	V					V		V
11	Fundamentals of Economics and entrepreneurship	Purpose: To develop basic knowledge of economic processes and skills in entrepreneurial activities. Content: The course aims to develop skills in analyzing economic concepts such as supply and demand, and market equilibrium. It includes the basics of creating and managing a business, developing business plans, risk assessment, and strategic decision-making.			V	V			V	V					
12	Ecology and life safety	Purpose: formation of ecological knowledge and consciousness, obtaining theoretical and practical knowledge on modern methods of rational use of natural resources and environmental protection. Contents: the study of the tasks of ecology as a science, the laws of the functioning of natural systems and aspects of environmental safety in working conditions, environmental monitoring and management in the field of its safety, ways to solve environmental problems; life safety in the technosphere, emergencies of a natural and man-made nature.			V				V	V			V		
13	Basics of Financial Literacy	Purpose: formation of financial literacy of students on the basis of building a direct link between the acquired knowledge and their practical application. Contents: using in practice all kinds of tools in the field of financial management, saving and increasing savings, competent budget planning, obtaining practical skills in calculating, paying taxes and correctly filling out tax reports, analyzing financial information, orienting in financial products to choose adequate investment strategies.							V	V					
CYCLE OF BASIC DISCIPLINES The university component															

14	Mathematics I	Purpose: to introduce students to the fundamental concepts of linear algebra, analytical geometry and mathematical analysis. To form the ability to solve typical and applied problems of the discipline. Contents_ Elements of linear algebra, vector algebra and analytical geometry. Introduction to the analysis. Differential calculus of a function of one variable. The study of functions using derivatives. Functions of several variables. Partial derivatives. The extremum of a function of two variables.	5			V									
15	Physics I	Purpose: to study the basic physical phenomena and laws of classical and modern physics; methods of physical research; the influence of physics on the development of technology; the relationship of physics with other sciences and its role in solving scientific and technical problems of the specialty. Contents: mechanics, dynamics of rotational motion of a solid body, mechanical harmonic waves, fundamentals of molecular-kinetic theory and thermodynamics, transfer phenomena, continuum mechanics, electrostatics, direct current, magnetic field, Maxwell's equations.	5			V									
16	Physics II	Purpose: to form students' knowledge and skills in using fundamental laws, theories of classical and modern physics, as well as methods of physical research as the basis of a system of professional activity. Contents: harmonic oscillations, damped oscillations, alternating current, wave motion, laws of refraction and reflection of light, quantum optics, laws of thermal radiation, photons, their characteristics, wave function, electrical conductivity of metals, atomic nucleus, its structure and properties, binding energy, radioactivity.	5			V									
17	Mathematics II	Purpose: To teach students integration methods. To teach you how to choose the right method for finding the primitive. To teach how to apply a certain integral to solve practical problems. Contents_ integral calculus of the function of one and two variables, series theory. Indefinite integrals, methods of their calculation. Certain integrals and applications of certain integrals. Improper integrals. Theory of numerical and functional series, Taylor and Maclaurin series, application of series to approximate calculations_	5			V									
18	Mathematics III	Purpose: To teach students integration methods. To teach you how to choose the right method for finding the primitive.The discipline is a continuation of Mathematics II. The course includes sections: ordinary differential equations and elements	5			V									

		of probability theory and mathematical statistics. Differential equations with separable variables, homogeneous, in full differentials, linear inhomogeneous differential equations with constant coefficients, systems of linear differential equations with constant coefficients, finding the probability of events, calculating the numerical characteristics of random variables, using statistical methods for processing experimental data are studied.														
19	Engineering and computer graphics	Purpose: To develop students' knowledge of drawing construction and skills in developing graphical and textual design documentation in accordance with standards. Content: Students will study ESKD standards, graphic primitives, geometric constructions, methods and properties of orthogonal projection, Monge's projection, axonometric projections, metric tasks, types and features of connections, creating part sketches and assembly drawings, detailing, and creating complex 3D solid objects in AutoCAD.	5			V										
20	General and structural geology	Purpose: to study the material composition of the Earth, geodynamic processes and forms of occurrence of rocks. Objectives: study of the material composition of the Earth, mineralogical, chemical; geodynamic exogenous and endogenous processes, forms of occurrence of igneous, sedimentary, metamorphic rocks, patterns of their location and consistency, geological conditions of formation, faults, general patterns of development of the earth's crust.	4			V										
21	The Earth's physics fundamentals	Purpose: Formation of knowledge about the physical processes occurring in the bowels of the Earth, its structure, evolution and study methods for use in the interpretation of geophysical data Content:General ideas about the internal structure of the Earth, the concept of the origin and structure of the Earth's shells, the physical properties of rocks, the theory of the origin of the Earth's gravitational, electromagnetic, thermal and radioactive fields and their structure are considered. The course examines seismicity, the causes of earthquakes, associated hazards and the possibilities of seismic earthquake prediction	6	V		V										V
22	Geotectonics of Kazakhstan	Purpose: Study of the structural and tectonic structure of the earth’s crust in Kazakhstan to understand the processes of formation of faults, folds and other geological structures Contents: Studies the features of the structure and development of tectonic structures of various ranks; deep structure of the Earth and the evolution of the structure of lithospheric plates;	5			V					V					

		cause-and-effect relationships of tectonic processes with the structure of the earth's crust and upper mantle. Stages and causes of tectonic movements, development of the structure of the lithosphere as a whole. Geological and tectonic structure of Kazakhstan													
23	Hardware and methodology for seismological observations	Purpose: Study of the types and purposes of seismological equipment and their technical, methodological and software for collecting, storing and processing seismological data Contents: The characteristics of seismometric channels and seismological data bases for conducting seismological studies are considered. Specialized networks for collecting (registration), storing, transmitting and processing seismic and geophysical information. Operations when checking and setting up stationary equipment. Stages of seismological observations	5									V	V	V	
24	Seismic Wave Propagation in the Earth's Lithosphere fundamentals	Purpose: Studying the types of seismic waves and their characteristics to study the internal structure of the Earth Contents: Internal structure of the Earth. Seismic waves are the main source of information about the deep structure of the Earth. Characteristics of longitudinal P- and transverse S- waves and their distribution. Elastic modules. Body waves. Wave relationships. Surface waves of Rayleigh and Love. Surface wave dispersion. Mantle surface waves. Analysis of the possible trajectories of seismic waves inside the Earth	5			V					V				
25	GIS technologies for collection, processing, and visualization of seismology data	Purpose: Studying the basics of mapping and creating geographic information systems for the purpose of visualizing spatial data and constructing maps Contents: The course consists of several sections: basic terms, concepts and definitions of a geographic information system (GIS). Collection, storage and analysis of information in GIS. Providing graphical interpretation of spatial information. Use of GIS in seismology. Study of changes in seismological parameters over time based on GIS models. Examples of GIS software products	5	V		V					V		V	V	V
26	Seismicity of the tectonosphere	Purpose: Study of ideas about the composition and structure, vertical-lateral heterogeneity of the tectonosphere Contents: Global patterns of earthquake distribution. Characteristics and energy sources of deep geological processes. Seismicity and convection in the tectonosphere, mantle plumes and secular cooling of the Earth. Depth and conditions of origin of the main types of magmas. The Earth's crust of continents and oceans, its structure and methods of articulation on passive-	5	V		V				V					V

		active continental margins. The nature of the Mohorovicic surface. Lithosphere and asthenosphere, their interaction													
27	Tectonophysics and digital modeling	Purpose: study the physics of tectonic phenomena and computational methods for creating models of the earth's crust to predict seismic activity Contents: Classification, types of study and formation of tectonic structures. Movements, their characteristics and changes in tectonic areas. Mechanical and rheological properties of rocks, their assessment based on geophysical data. Tectonophysics and seismicity. Methodology for equivalent modeling of tectonic processes and structures. Using digital modeling to solve tectonophysics problems	5	V		V					V		V	V	V
28	Tectonic and seismic zoning of the territory of Kazakhstan	Purpose: study methods for studying tectonic processes, determining seismic risks and seismic zoning Contents: Seismicity distribution. Determination of zones of seismic activity. Earthquake forecast. Recurrence of earthquakes. Strong and destructive earthquakes. Identification of seismically active zones and identification of factors influencing seismic activity. Assessing the probability of earthquakes in the regions of Kazakhstan using data on earthquakes, geological and geophysical research and modeling. Construction of maps of seismic activity on a tectonic basis	5	V		V				V					V
29	Digital geomechanical models	Purpose: Study the basics of modeling geomechanical processes that occur during an earthquake Contents: Basic definitions and characteristics of analytical geomechanics. Stress, strain and displacement, and their relationships. Natural and artificial stress-strain states of rocks caused by an earthquake, their types. Theoretical methods for solving geomechanical problems. Methods for numerical modeling of geomechanical processes. Finite element method. Analysis of the harmful effects of mining operations based on the results of mathematical modeling	5	V		V					V		V	V	V
30	Educational practice	It is intended for conducting field geophysical methods based on knowledge of the physical basics of methods, the range of tasks to be solved, types of surveys, the principle of operation and device of equipment and geophysical equipment. Students will get acquainted with the design of field geophysical methods, learn how to test and calibrate equipment, conduct field measurements, get an idea of primary processing, build work results in the form of maps, graphs and sections.	2	V		V			V	V	V	V			
Cycle of basic disciplines															

Component of choice															
31	Introduction to Seismology	Purpose: Learn basic terms to better understand and analyze earthquakes and their consequences Contents: Designed to study the basic concepts of seismology. Earthquakes and seismic waves, epicenter and hypocenter, magnitude and intensity. Seismographs and seismometers, seismic networks. Deep sounding and inversion methods. Forecasting and preventing earthquakes is the main task of seismology. Methods for studying and predicting earthquakes, a list of measures to protect the population and reduce risks	5	V		V			V		V	V	V	V	V
32	Seismology fundamentals	Purpose: Study of general ideas about seismology, the history of its development and evolution Content: The concepts of catastrophic earthquakes, methods for assessing the intensity of earthquakes, natural vibrations of the Earth, concepts of seismic rays and hodographs, sources of seismic waves, energy characteristics of earthquakes, types and features of hodographs, seismic waves and their classifications are briefly studied. A description of the composition and operating principle of seismological equipment is given and the structures of seismic services are studied.				V					V				
33	Fundamentals of Sustainable Seismic Zoning	Objective: Study of seismic hazard of seismically active territories taking into account sustainable development and protection of ecosystems. Content: Zoning by seismic hazard taking into account seismic impacts on environmental sustainability. Units of intensity measurement. Ecological and social aspects of design and construction in seismically active areas, risk reduction for the population and the environment. Modern methods of seismic hazard assessment, seismic zoning maps, detailed seismic microzoning based on infrastructure sustainability and minimization of environmental impacts.		V		V					V	V	V	V	V
34	Legal regulation intellectual property	Purpose: the goal is to form a holistic understanding of the system of legal regulation of intellectual property, including basic principles, mechanisms for protecting intellectual property rights and features of their implementation. Content: The discipline covers the basics of IP law, including copyright, patents, trademarks, and industrial designs. Students learn how to protect and manage intellectual property rights, and consider legal disputes and methods for resolving them.							V	V					
35	Applied Seismology	Purpose: Study the patterns of ground vibrations during an earthquake in order to improve the standards of earthquake-resistant construction	5			V					V				

		Contents: Studies the basic patterns of earthquakes. Dangerous phenomena accompanying earthquakes. Causes of earthquakes, lithospheric plates, seismically active belts of the Earth. Mechanisms of earthquake occurrence. Questions of earthquake registration. Seismic waves and determination of earthquake source parameters. Features of plane seismic waves. Surface seismic waves. Mechanics of earthquakes. Ground movements during strong earthquakes. Microseismic zoning													
36	Applied Geophysics	Purpose: To study modern methods of geophysics used in solving applied problems of geology Contents: The classification of methods of applied geophysics is considered. Geological problems of applied geophysics. Physical fields and physical properties of rocks. The physical foundations of gravity and magnetic exploration, electrical exploration, seismic exploration, and nuclear geophysics. Special attention is paid to the study of systems and methods of geophysical observations using geophysical instruments and the use of geophysical methods to solve the simplest typical geological problems.				V					V	V			
37	Geophysical methods in seismology	Purpose: Studying the range of seismological problems for studying the internal structure of the Earth using geophysical data Contents: Physical foundations of gravity prospecting, magnetic prospecting, electrical prospecting, seismic prospecting, radiometric methods. Range of seismological problems solved by geophysical methods. Internal structure of the Earth according to seismic data. Microseisms, their genesis and types of movements. Seismic models of the crust and mantle, determination of velocities and construction of deep boundaries. Prospects for the use of geophysical methods in solving seismological problems		V				V						V	
38	Fundamentals of Artificial Intelligence	Purpose: to familiarize students with the basic concepts, methods and technologies in the field of artificial intelligence: machine learning, computer vision, natural language processing, etc. Contents: general definition of artificial intelligence, intelligent agents, information retrieval and state space exploration, logical agents, architecture of artificial intelligence systems, expert systems, observational learning, statistical learning methods, probabilistic processing of linguistic information, semantic models, natural language processing systems.				V				V					

39	Introduction to remote sensing of the Earth	Purpose: Study of the theory, terms, concepts and definitions of earth remote sensing (ERS) methods Contents: Sources and components of radiation. The concept of the electromagnetic spectrum. Hardware features of remote sensing, equipment carriers. Aero- and space photography. Types and formats of digital remote sensing data. Neural network algorithms for information typing. Physico-mathematical basis for processing remote sensing results. Types and types of pictures. images. Distortion models. Coordinate transformation and evaluation of transformation errors algorithms	5			V					V	V	V	V	
40	Geodynamic monitoring	Purpose: Study of methods for monitoring and forecasting geodynamic processes Contents: Geodynamics, seismicity, geodynamic phenomena, deformation processes, earthquakes, seismic processes. Objects of study, zones of active faults and seismic activation. Natural and man-made processes associated with the development of mineral deposits, above-ground and underground construction, etc. Types of geodynamic processes. Geodynamic polygon. Requirements for creating a GDM system. Range of tasks of the GDM. Presentation of GDM results		V		V			V		V	V	V	V	V
41	Geoecological monitoring	Purpose: study of methods and technologies used for observation, analysis and assessment of the state of the natural environment and ecosystems Contents: Concept of monitoring, meaning, types, functions, goals and objectives of GM. Methods for assessing the state of the environment. Equipment and technology of geoecological monitoring. Instruments and methods for monitoring environmental quality. Identification of zones of geo-ecological crisis. A set of environmental monitoring methods. Methods of geophysical, geochemical, biological, agrochemical, landscape research			V				V	V		V			
42	Fundamentals of sustainable development and ESG projects in Kazakhstan	Purpose: the goal is for students to master the theoretical foundations and practical skills in the field of sustainable development and ESG, as well as to develop an understanding of the role of these aspects in the modern economic and social development of Kazakhstan. Contents: introduces the principles of sustainable development and the implementation of ESG practices in Kazakhstan, includes the study of national and international standards, analysis of successful ESG projects and strategies for their			V					V					

		implementation in enterprises and organizations.													
43	Digital Models of zones with strong earthquakesources	Purpose: Studying methods for constructing digital models of focal zones of strong earthquakes Contents: Definitions and characteristics of the source of a strong earthquake. Velocity model of the medium, kinematics of seismic waves. Study of displacements in the focal zone, dynamic characteristics of seismic waves. Development of scientific ideas about earthquake sources. Square distribution of first arrivals of P-waves, seismic moment. Tectonic interpretation of source zones. Inverse problem of source theory. Earthquake source modeling	4			V					V			V	
44	Earthquakes, seismic hazards and seismic risks	Purpose: Study the basics of earthquakes, seismic hazards and seismic risks Contents: History of the development of recording seismic events and their mapping. Earthquake and classification of earthquakes. Seismic hazard forecasting. Seismic hazard on the territory of the Republic of Kazakhstan. Seismic risk analysis methodology. Vulnerability of buildings and risks during earthquakes. Earthquake protection and risk management. Methodology of a systematic approach to assessing and reducing seismic risk. Earthquake monitoring and forecasting	4	V		V					V		V	V	V
45	Earthquake surces parameterization	Purpose: Studying sections of seismology related to the determination of quantitative parameters of earthquakes Contents: Earthquake intensity. Intensity scales. Equations of macroseismic field. Basic instrumental parameters of lesions. Coordinates and depth of the hypocenter. Types of magnitudes and methods for their determination. Local magnitude. Body wave magnitude. Magnitude from surface waves. Moment magnitude. Seismic energy and energy class. Seismic moment. Focal mechanisms and seismic moment tensor. Dynamic parameters of lesions	4	V		V					V	V	V	V	V
46	Assessment of Seismic Hazard using GIS	Purpose: Study of GIS to solve problems of monitoring seismic conditions and making earthquake forecasts Contents: Purpose, functions, graphic visualization of the development of the seismic process in time and space using the specialized GIS system “Prediction”. Processing of earthquake data, statistical analysis and presentation of results. Module "Isoseists". Assessing the possible consequences of seismic vibrations using isoseismal maps. Methods for predicting earthquakes and increasing information content based on the use of GIS technologies	5	V		V					V	V	V	V	V

47	Geoinformation System for earthquake and rockburst prediction	Purpose: study methods of analysis and interpretation of geodata using modern geoinformation technologies for forecasting and managing the risks of geological disasters Contents: Concepts, technologies and GIS tools. Seismic monitoring methods, main signs of earthquakes, their classification and consequences. Factors causing rock bursts, methods for predicting and minimizing risks. Methods for interpreting geodata to create predictive models, create risk maps, make decisions and plan disaster prevention measures	5	V		V			V		V		V	V	V
48	Methods and systems for seismic and deformation monitoring of seismically regions of Kazakhstan	Purpose: Study of methods and systems for seismic deformation mon-itoring of seismic regions of Kazakhstan to prevent man-made seismic events Contents: Geodynamically active areas of Kazakhstan. Fundamental problems of mining geophysics. Forecasting of catastrophic natural and man-made phenomena (land subsidence, earthquakes, rock and rock tectonic impacts; rock outbursts; destruction of quarry sides, etc.). Creation of methodological foundations and hardware for monitoring systems. GPS monitoring and radar interferometry methods	5	V		V					V	V	V	V	V
49	Characteristics of seismic waves and the environment state of the earthquake sources	Purpose: Studying the theory of elastic wave propagation depending on the properties of rocks to establish the influence of earthquake sources on the deformation of the geological environment Contents: Relationship between the characteristics of seismic waves (amplitude, period, frequency, polarity) with the physical parameters of earthquake sources and classification of earthquake sources; studying the methodology for the state of earthquake sources and their mechanism based on velocity inhomogeneities (longitudinal and transverse velocities and their ratios)	6			V					V				
50	Mathematical theory of seismic waves	Purpose: To study the application of mathematical laws of propagation of seismic vibrations to solve seismological problems Contents: Algorithms and formulas that describe the propagation of seismic waves through the quantities that caused the movement. Analytical expressions for the parameters of seismic vibrations based on the physical and mathematical laws of the dynamic theory of elasticity, mathematical connections for modeling wave processes in seismology when assessing the seismicity of seismically active areas	6			V					V				
51	Mathematical models of	Purpose: Study of mathematical methods and models used to	6			V					V				

	seismic and deformation waves	study seismic activity, propagation of seismic waves and deformations of the earth's crust Contents: Mathematical models of nonlinear oscillations of seismic waves and nonlinear physics of the Earth's deformation processes to establish a connection between wave dynamics and the deformation of the real geological environment and earthquake sources. The issues of studying the deformation of the real geological environment as a nonlinear process reflected in geophysical fields are discussed, the study of which makes it possible to explain the nature of the geodynamic phenomena of the earth's crust													
52	ESG principles in inclusive culture	Purpose of the course: It focuses on studying ESG (Environmental, Social, Governance) principles and their interaction with the creation of an inclusive culture within an organization. Content: Students will gain knowledge on how implementing ESG principles contributes to corporate social responsibility, sustainable development, and equal opportunities for all employees, including those who may face various forms of discrimination. The course will help students understand the importance of an inclusive culture in achieving long-term business goals and ensuring sustainable organizational development.	5		V				V	V					
Cycle of profile disciplines The university component															
53	Basic principles for constructing seismic monitoring systems	Purpose: Study technologies for monitoring seismic activity, methods of data analysis, earthquake and geological hazard warning Contents: Organization of seismic monitoring. Registration, processing and interpretation of seismological data. Large-scale effect of earthquakes. Principles and theoretical foundations of organizing seismic monitoring in weakly active platform areas. Study of regional and local seismic activity of a territory or local area. Seismic monitoring with single seismic stations. Small aperture seismic group. Maps of seismic microzoning of the territory of Kazakhstan	4	V		V					V	V	V	V	V
54	Digital recording and processing of seismic information	Purpose: Study of seismic data formats, processing methods and determination of the main parameters of a seismic event using software processing systems Contents: Aimed at studying the sources of seismic signals. Types of seismic waves. Processing data from an individual station, seismic group, seismic network. Magnitudes and energy	5	V		V					V		V	V	V

		class, their definition. Global monitoring networks. International data centers and their products. Construction of the focal mechanism													
55	Probabilistic assessments of the degree of seismic hazard	Purpose: Study of classical and innovative methods of probabilistic analysis of seismic hazard (VASO) and their application Contents: Deterministic approach to seismic hazard analysis (DASO), advantages and disadvantages. Methods for calculating the maximum possible earthquake magnitude based on DASO. Determination of the expected level of exceedance of seismic hazard parameters (WASO), the level of reliability and probability for a given period of time. Seismic hazard according to VASO and seismic shaking. Classic approach for Cornell-McGuire VASO	4			V					V				
56	Seismic hazard assessment of oil and gas bearing areas of Kazakhstan	Purpose: Assessment of geodynamic risk and possible negative consequences of long-term development of an oil and gas field Contents: Study of the features of the geological structure and geological and physical characteristics of oil and gas fields Geodynamic monitoring, general goal and main tasks. Geodynamic risk factors. Tectogenic and technogenic factors. A set of geodynamic monitoring methods. High-precision leveling, satellite GNSS observations and high-precision gravity surveys. Methods and techniques for geodynamic monitoring of subsoil conditions. Comprehensive interpretation of geodynamic monitoring data	6	V		V					V	V	V	V	V
Cycle of profile disciplines Component of choice															
57	Engineering seismology	Purpose: Study of basic concepts, definitions and terms of engineering seismology and areas of application Contents: Range of problems solved by engineering seismology. Carrying out engineering surveys for the construction of buildings and structures. Engineering-geological surveys as the main tool for seismic microzoning. Seismic microzoning of cities. Refinement of seismic zoning using the results of engineering seismology. Ground vibrations during a strong earthquake. Soil mechanics. Features of seismic impacts. Subject of engineering seismology and earthquake-resistant construction	5	V		V					V	V	V	V	V
58	Earthquake precursors	Purpose: Study and forecast earthquakes based on earthquake precursors Contents: Areas of complex terrain. Processes occurring in the	5	V		V					V			V	V

		earth's crust, faults, their types. Mechanics of destruction and formation of earthquake source. Long-, medium- and short-term precursors of earthquakes. Foreshocks as natural earthquake indicators. Geochemical and hydrogeodynamic, biological precursors of earthquakes. Distance from the epicenter, duration of precursors and magnitude of earthquakes. Regional differences in the manifestation of earthquake precursors. Earthquake forecast systems													
59	Modern approaches to emergency prevention	Purpose: Study the principles of forecasting and preventing natural and man-made hazards and minimizing the consequences Contents: Types and sources of emergencies. Methods for reducing the risk of emergencies and mitigating the consequences. New security strategy. Principles of risk management: justification of practical activities, optimization of protection, integral assessment of hazards, sustainability of ecosystems. Risk identification and assessment. Creation of monitoring systems. Long-term, medium-term, short-term forecasts for the implementation of emergencies and assessment of possible consequences	5	V		V			V	V	V	V	V	V	V
60	Seismic effects on buildings and constructions	Purpose: Study of theoretical and practical engineering problems for seismic analysis and design Contents: Students will study seismology, the basics of seismic analysis, design and construction of earthquake-resistant buildings and structures. As part of the course, students will analyze real-life earthquake cases and the consequences for buildings and structures. They will also become familiar with the use of modern computer programs and models	5			V			V	V	V		V	V	
61	Elements of aseismic construction	Purpose: Study the influence of seismic processes on construction and construction design taking into account seismic stability Contents: Concepts, laws of seismology, sources of seismic influences. The impact of seismic waves on buildings and structures, methods for measuring and analyzing seismic loads. Design of buildings taking into account seismic activity, seismic resistance analysis. Application of earthquake-resistant structures, materials and technologies in construction. Measures to strengthen and modernize existing buildings to improve seismic resistance	5	V		V			V	V	V	V	V	V	V
62	Classification and characterization of natural	Purpose: Study of the causes and mechanisms of natural disasters, their classifications and characteristic features for	5	V		V				V	V		V	V	V

	emergencies	predicting, preventing and minimizing the consequences of disasters Contents: Studies natural phenomena: earthquakes, floods, tsunamis and others. Mechanisms of occurrence and development of these phenomena. Factors influencing their intensity. Information resources related to problems of natural emergencies. Study of methods and strategies for preventing and mitigating the impact of natural disasters													
63	Seismic methods of nuclear weapons test control	Purpose: Study of the principles of detection of seismic signals arising from underground explosions and monitoring of underground nuclear activities Contents: Seismological foundations of methods for monitoring nuclear explosions. Physics of seismic sources of earthquakes and nuclear explosions. Types of nuclear explosions and seismic waves. Detection of phenomena by a station, seismic group, seismic network. Magnitude detection threshold, identification, assessment of the power of explosions. International Data Centre, Seismic Calibration. Examples of recording nuclear explosions in Asia	6	V		V			V	V	V	V	V	V	V
64	Theory and methodology of seismological research	Purpose: studying the theoretical and experimental foundations of seismological research methods with the skills of data processing and interpretation Contents: Vibrations and elastic waves, spectra, oscillatory systems. Deformations and stresses, elastic moduli. Concepts of seismic wave kinematics. Proportionality between strains and stresses in the medium, the speed of propagation of seismic waves, the dependence of the velocities Vp and Vs on pressure and temperature, absorption of elastic waves in rocks, seismic models	6			V					V				
65	Seismic sources	Purpose: Study of natural and man-made sources of seismic waves, their characteristics, impact on the environment, methods of observation and recording of these sources Contents: Studies: pulsed, continuous, natural and man-made seismic sources. Tectonic, volcanic, salt dome and glacial earthquakes. Landslides, mudflows, avalanches, thunderstorms. Man-made earthquakes. Natural-technogenic seismicity. Quarry and other explosions. Examples of records from various seismic sources. Source parameters in seismic bulletins. Basics of recognizing the nature of seismic events	6	V		V					V	V	V		V
66	Technogenic seismicity: causes and classification	Purpose: Studying the sources of seismic events, methods for monitoring the effects of man-made seismicity on geological	5			V			V	V	V				

		structures and activation of seismically active zones Contents: Man-made seismicity, man-made disasters, their classification. Local and local disasters. Territorial and regional man-made events. Technogenic events of a federal scale. Global disasters. Classification of technogenic seismicity by origin. Causes of man-made events. Preventive, organizational, engineering measures to predict emergency situations. Risks and consequences of man-made seismicity													
67	Technogenic and natural seismic activity at the exploitation of mineral deposits	Purpose: Study of factors of seismic phenomena in mineral deposits, their monitoring and prevention Contents: Tectogenic-technogenic causes of man-made earthquakes. Classification of technogenic seismicity. The influence of hydrocarbon production and the volume of extracted rock mass on seismic activity. Accumulation of seismic activity from the activation of natural tectonic processes. Energy dump. Gutenberg-Richter law. Graphs of the frequency of geodynamic events on the MPI. Assessment of man-made seismic hazard. The essence of geodynamic monitoring at mineral deposits	5	V		V					V	V	V	V	V
68	Modern approaches to prevention and mitigation of technogenic Disasters	Purpose: Explore the principles of technological innovation, risk management, public safety strategies and efficient use of resources Contents: Development of remote sensing systems, process automation, artificial intelligence, threat detection and management data analytics. Creation of monitoring systems: geographic information systems, satellite surveillance, automatic early warning systems. Development of risk management methods: engineering surveys, analysis of structures, development of protection strategies and risk assessments. Development of international standards for the prevention and management of man-made disasters	5	V		V			V	V	V	V	V	V	V
69	Digitalization of earthquake parameters	Purpose: Study of algorithms for converting seismic data into digital format to obtain information about earthquake parameters Contents: Reasons for digitalization of seismic recordings. Using synthetic records of strong earthquakes. Parameters of synthetic records and seismotectonic conditions. Source and medium parameters from seismic recordings. Refinement of epicenter coordinates using an azimuthal approach using seismic recordings. Location of the epicenter and activity of fault tectonics based on recording of longitudinal waves. Systems of	5			V				V					

		digital algorithms for determining the parameters of weak earthquake sources													
70	Paleo- and historical seismology	Purpose: Study of prehistoric earthquakes based on paleo- and archaeoseismological studies to reconstruct past natural events Contents: History of the study of earthquakes. Mode of manifestation of strong paleoearthquakes. Methods for studying paleoseismic dislocations in areas of seismically active faults. Periods of seismic activation and calm. Sources of strong historical and paleo-earthquakes. Seismic deformations of archaeological sites. Age of seismic scarps and earthquake magnitude. Release of seismic activity along active faults. Use of paleo- and historical seismology data	5			V					V				
71	Geomechanics of rocks	Purpose: Studying the patterns of development of geomechanical processes in rock formations to determine the parameters of development systems that ensure safe working conditions Contents: Experimental determination of the mechanical properties of rocks, modeling and forecasting of geomechanical processes in rocks, assessment of the condition of mine workings and other elements of MPI development systems. Geomechanical processes developing in rock massifs, methods for determining the parameters of elements of development systems that ensure safe working conditions	5			V					V				
72	Technogenic earthquakes in the development of deposits of solid minerals	Purpose: Study of technogenic impacts and factors determining technogenic geophysical phenomena in the solid deposits Contents: Physico-chemical processes in the Earth, elasticity and elastic moduli, stress and deformation, speed of propagation of elastic waves. Mountain blow; probable causes of rock bursts; stress state of the mountain range; technogenic factors; natural factors, underground nuclear explosions (UNE). Classification of man-made earthquakes. Technogenic earthquakes caused by filtration processes. Possible consequences of strong man-made earthquakes	5			V					V				
73	Technogenic seismicity of mining regions and its impact on seismic hazard	Purpose: Study the principles of monitoring and analysis of seismic activity to minimize the impact of development processes Contents: Technogenic seismicity of mining regions, classification. Seismic processes and phenomena. Emissions and shifts of rocks in mines. Water and filling underground cavities. Emissions of gases, chemicals or waste from mining and processing plants. Primary and induced technogenic	5	V		V			V	V	V	V	V	V	V

		seismicity. The concept of rock burst. Seismic zoning. Hazard (short-term, medium-term, long-term)													
74	Seismicity and seismic assessment of mining regions of Kazakhstan	Purpose: Study of solid state monitoring and protection of structures to assess seismic risk and hazards to personnel and equipment Contents: Underground impacts and earthquakes, natural processes and active ore extraction. “Forced” or “induced” seismicity, causes and nature of origin in ore deposits. Discrepancy between the actual and predicted intensity of earthquakes. Measures to reduce the destructive consequences and human casualties of man-made earthquakes. Geodynamic monitoring of the state of the subsoil of ore deposits	5	V		V			V	V	V	V	V	V	V
75	Interpretation and digital models of geological environments based on seismology data	Purpose: Familiarization with the principles of creating digital media models based on seismic information to study the geological structure and manage seismic risk Contents: Physical principles of seismology, classification of methods. Methodology for geological interpretation of seismic and acoustic data. Examples of data interpretation during scientific expeditions and geotechnical research. Limitations of seismic methods and adequate assessment of their capabilities. Construction of models of the study area and features of their interpretation	5			V					V				
76	Processing and interpretation of seismic data	Purpose: Familiarization with the stages of processing and geological interpretation of seismic data to study the deep structure of the area Contents: Concepts of interpretive models, useful signals and interference. Corrections introduced into seismic data. Time and depth sections. Construction of structural maps. Structural and dynamic interpretation. Study of changes in interval velocity along a profile. Analysis of effective speeds. Absorption coefficient values calculated for some intervals. Values of amplitudes of reflected waves. Prediction of geological section	5			V					V		V		
77	Static modeling of geological enviroments based on Seismic Data	Purpose: Studying the creation of models of the physical and geological properties of the earth’s crust for assessing seismic hazards and field exploration Contents: Construction of FGM using seismic data. Velocity model of the environment. Types of FGM and principles of their construction. Geological model (GM), petrophysical model (PFM) based on the GM, mathematical model (MM) - the basis for the implementation of computational procedures. Requirements for FGM. Using FGM to solve applied problems	5	V		V					V	V	V	V	V

78	Forecasting of seismoacoustic models and types of geological section based on seismic data	Purpose: Studying the algorithm of seismic-acoustic models that describe the influence of cracks, voids and other physical parameters on the speed and direction of propagation of seismic waves in order to simulate various types of geological sections Contents: Stages of processing and interpretation of seismic data. Patterns of distribution of types of geological section. Methods for predicting the geological section. Methods for predicting the filtration properties of reservoirs. Software for PGR. Using geological section forecasting for optimal placement of exploration and production wells	4	V		V					V		V	V	V
79	The methodology of mapping a geological section	Purpose: Study of mapping rock types, structural features, faults, voids and other geological features Contents: Methodology for mapping types of geological section. Problems of geological interpretation of seismic data. Contrast between the lithological and facies composition of reservoirs and their FES. The concept of macro-descriptions of sections with different properties and productivity. Typing of sections by zone, deposit, location. Linear and nonlinear interpolation and extrapolation of parameters of various types of geological sections. Typing methods for seismic data	4			V					V				
80	Introduction to geological section prediction based on seismic data	Purpose: Acquiring initial knowledge about the methodology, hardware technologies and specialized software for predicting the geological section (PGR) Contents: Relevance, essence, objectives, main elements of the PGR. Physical foundations of seismic methods and requirements for seismic exploration techniques during geological exploration. Features of processing and interpretation of seismic data for PGR and sequence stratigraphy. Seismic geological modeling for solving PGR problems. Efficiency of using seismic survey results to solve problems of geological exploration and seismostratigraphic analysis	4			V					V				
81	Production practice I	The first industrial practice is the initial immersion of young specialists into the production environment and provides for the participation of bachelors in the process of preparing, organizing and conducting field seismological surveys from collecting documentation for participation in the tender to writing a report explanatory note. Bachelors can participate in field seismological observations and desk work, as well as in the work of public services, institutions and companies	2					V	V	V	V	V	V	V	V
	Production practice II	It is a continuation of the production practice I. In the process of practical training, students gain professional skills, get	3					V	V	V	V	V	V	V	V

		acquainted with the stages, organization and management of seismological work, the features of seismological surveys, introduction into field life during observations, gain experience in organizational, social, educational and professional work.														

5. Curriculum of the educational program

NON-PROFIT JOINT STOCK COMPANY
"KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY NAMED AFTER K.I. SATBAYEV"

SATBAYEV UNIVERSITY

«APPROVED»
Decision of the Academic Council
NPJSC«KazNRTU
named after K.Satbayev»
dated 06.03.2025 Minutes № 10

WORKING CURRICULUM

Academic year	**2025-2026 (Autumn, Spring)**
Group of educational programs	**B052 - "Earth Science"**
Educational program	**6B05208 - "Seismology"**
The awarded academic degree	**Bachelor of natural sciences**
Form and duration of study	**full time - 4 years**

Discipline code	Name of disciplines	Block	Cycle	Total ECTS credits	Total hours	lek/lab/pr Contact hours	in hours SIS (including TSIS)	Form of control	Allocation of face-to-face training based on courses and semesters								Prerequisites
									1 course		2 course		3 course		4 course		
									1 sem	2 sem	3 sem	4 sem	5 sem	6 sem	7 sem	8 sem	
CYCLE OF GENERAL EDUCATION DISCIPLINES (GED)																	
M-2. Module of physical training																	
KFK101	Physical culture I		GED, RC	2	60	0/0/30	30	E	2								
KFK102	Physical culture II		GED, RC	2	60	0/0/30	30	E		2							
KFK103	Physical culture III		GED, RC	2	60	0/0/30	30	E			2						
KFK104	Physical culture IV		GED, RC	2	60	0/0/30	30	E				2					
M-3. Module of information technology																	
CSE677	Information and communication technology		GED, RC	5	150	30/15/0	105	E			5						
M-4. Module of socio-cultural development																	
HUM101	History of kazakhstan		GED, RC	5	150	15/0/30	105	E		5							
HUM134	Module of socio-political knowledge (cultural studies, psychology)		GED, RC	5	150	30/0/15	105	E			5						
HUM132	Philosophy		GED, RC	5	150	15/0/30	105	E				5					
HUM120	Module of socio-political knowledge (sociology, political science)		GED, RC	3	90	15/0/15	60	E				3					
M-1. Module of language training																	
LNG108	Foreign language		GED, RC	5	150	0/0/45	105	E	5								
LNG104	Kazakh (russian) language		GED, RC	5	150	0/0/45	105	E	5								
LNG108	Foreign language		GED, RC	5	150	0/0/45	105	E		5							
LNG104	Kazakh (russian) language		GED, RC	5	150	0/0/45	105	E		5							
M-5. Module of anti-corruption culture, ecology and life safety base																	
CHE656	Ecology and life safety	1	GED, CCH	5	150	30/0/15	105	E				5					
MNG489	Fundamentals of economics and entrepreneurship	1	GED, CCH	5	150	30/0/15	105	E				5					
PET519	Fundamentals of scientific research methods	1	GED, CCH	5	150	30/0/15	105	E				5					
HUM136	Fundamentals of anti-corruption culture and law	1	GED, CCH	5	150	30/0/15	105	E				5					
MNG564	Basics of Financial Literacy	1	GED, CCH	5	150	30/0/15	105	E				5					
CYCLE OF BASIC DISCIPLINES (BD)																	
M-6. Module of physical and mathematical training																	
MAT101	Mathematics I		BD, UC	5	150	15/0/30	105	E	5								

PHY111	Physics I		BD, UC	5	150	15/15/15	105	E	5								
MAT102	Mathematics II		BD, UC	5	150	15/0/30	105	E		5							MAT101
PHY112	Physics II		BD, UC	5	150	15/15/15	105	E		5							PHY111
MAT103	Mathematics III		BD, UC	5	150	15/0/30	105	E			5						MAT102
M-7. Module of basic training																	
GEN429	Engineering and computer graphics		BD, UC	5	150	15/0/30	105	E	5								
AAP173	Practical training		BD, UC	2				R		2							
M-8. Seismological module																	
GEO198	General and structural geology		BD, UC	4	120	30/15/0	75	E	4								
GPH497	The Earth's physics fundamentals		BD, UC	6	180	30/30/0	120	E			6						
GPH452	Introduction to Seismology	1	BD, CCH	5	150	30/15/0	105	E			5						
GPH453	Seismology fundamentals	1	BD, CCH	5	150	30/15/0	105	E			5						
MNG562	Legal regulation of intellectual property	1	BD, CCH	5	150	30/0/15	105	E			5						
GPH543	Fundamentals of Sustainable Seismic Zoning	1	BD, CCH	5	150	30/15/0	105	E			5						
GPH444	Geotectonics of Kazakhstan		BD, UC	5	150	30/15/0	105	E				5					
GPH445	Hardware and methodology for seismological observations		BD, UC	5	150	30/15/0	105	E				5					
GPH455	Applied Seismology	1	BD, CCH	5	150	30/15/0	105	E				5					
GPH456	Applied Geophysics	1	BD, CCH	5	150	30/15/0	105	E				5					
GPH457	Geophysical Methods in Seismology	1	BD, CCH	5	150	30/15/0	105	E				5					
CSE831	Fundamentals of Artificial Intelligence	1	BD, CCH	5	150	15/0/30	105	E				5					
GPH449	Tectonophysics and digital Modeling		BD, UC	5	150	30/15/0	105	E					5				
GPH446	Seismic Wave Propagation in the Earth's Lithosphere fundamentals		BD, UC	5	150	30/15/0	105	E					5				
GPH447	GIS technologies for collection, processing, and visualization of seismology data		BD, UC	5	150	30/15/0	105	E					5				
GPH448	Seismicity of the tectonosphere		BD, UC	5	150	30/15/0	105	E					5				
GPH450	Tectonic and seismic zonation of the territory of Kazakhstan		BD, UC	5	150	30/15/0	105	E					5				
GPH458	Introduction to remote sensing of the Earth	1	BD, CCH	5	150	30/15/0	105	E					5				
GPH459	Geodynamic Monitoring	1	BD, CCH	5	150	30/15/0	105	E					5				
GPH460	Geoecological Monitoring	1	BD, CCH	5	150	30/15/0	105	E					5				
MNG563	Fundamentals of sustainable development and ESG projects in Kazakhstan	1	BD, CCH	5	150	30/0/15	105	E					5				
CHE950	ESG principles in inclusive culture	1	BD, CCH	5	150	30/0/15	105	E					5				
GPH451	Digital geomechanical models		BD, UC	5	150	30/15/0	105	E						5			
GPH461	Digital Models of zones with strong earthquakesources	1	BD, CCH	4	120	30/15/0	75	E						4			
GPH462	Earthquakes, seismic hazard, and seismic risks	1	BD, CCH	4	120	30/15/0	75	E						4			
GPH463	Earthquake surces parameterization	1	BD, CCH	4	120	30/15/0	75	E						4			
GPH464	Assessment of Seismic Hazard using GIS	2	BD, CCH	5	150	30/15/0	105	E						5			
GPH465	Geoinformation System for earthquake and rockburst prediction	2	BD, CCH	5	150	30/15/0	105	E						5			

GPH466	Methods and systems for seismic and deformation mon-itoring of seismically regions of Kazakhstan	2	BD, CCH	5	150	30/15/0	105	E					5				
GPH467	Characteristics of seismic waves and the environment state of the earthquake sources	1	BD, CCH	6	180	30/30/0	120	E						6			
GPH469	Mathematical models of seismic and deformation waves	1	BD, CCH	6	180	30/30/0	120	E						6			
GPH498	Mathematical theory of seismic waves	1	BD, CCH	6	180	30/30/0	120	E						6			
CYCLE OF PROFILE DISCIPLINES (PD)																	
M-9. Module of professional activity																	
AAP102	Production practice I		PD, UC	2				R				2					
GPH470	Basic principles for construct-ing seismic monitoring systems		PD, UC	4	120	30/15/0	75	E					4				
GPH471	Digital recording and pro-cessing of seismic information		PD, UC	5	150	30/15/0	105	E					5				
GPH472	Probabilistic assessments of the degree of seismic hazard		PD, UC	4	120	30/15/0	75	E					4				
AAP183	Production practice II		PD, UC	3				R					3				
GPH473	Seismic hazard assessment of oil and gas bearing areas of Kazakhstan		PD, UC	6	180	30/30/0	120	E						6			
GPH495	Seismic effects on buildings and constructions	1	PD, CCH	5	150	30/15/0	105	E						5			
GPH494	Elements of aseismic construction	1	PD, CCH	5	150	30/15/0	105	E						5			
GPH477	Classification and characteri-zation of natural emergencies	1	PD, CCH	5	150	30/15/0	105	E						5			
GPH474	Engineering seismology	2	PD, CCH	5	150	30/15/0	105	E						5			
GPH475	Earthquake precursors	2	PD, CCH	5	150	30/15/0	105	E						5			
GPH496	Modern approaches to emer-gency prevention	2	PD, CCH	5	150	30/15/0	105	E						5			
GPH478	Seismic methods of nuclear weapons test control	3	PD, CCH	6	180	30/30/0	120	E						6			
GPH479	Theory and methodology of seismological research	3	PD, CCH	6	180	30/30/0	120	E						6			
GPH480	Seismic sources	3	PD, CCH	6	180	30/30/0	120	E						6			
GPH481	Technogenic seismicity: causes and classification	4	PD, CCH	5	150	30/15/0	105	E						5			
GPH482	Technogenic and natural seis-mic activity at the exploitation of mineral deposits	4	PD, CCH	5	150	30/15/0	105	E						5			
GPH476	Modern approaches to preven-tion and mitigation of Techno-genic Disasters	4	PD, CCH	5	150	30/15/0	105	E						5			
GPH483	Digitization of earthquake parameters	1	PD, CCH	5	150	30/15/0	105	E							5		
GPH484	Paleo- and historical seismology	1	PD, CCH	5	150	30/15/0	105	E							5		
GEO694	Geomechanics of rocks	1	PD, CCH	5	150	30/15/0	105	E							5		
GPH485	Technogenic earthquakes in the development of deposits of solid minerals	2	PD, CCH	5	150	30/15/0	105	E							5		
GPH486	Technogenic seismicity of mining regions and its impact on seismic hazard	2	PD, CCH	5	150	30/15/0	105	E							5		
GPH487	Seismicity and seismic asessment of mining regions in Kazakhstan	2	PD, CCH	5	150	30/15/0	105	E							5		
GPH488	Interpretation and digital models of geological environments based on seismology data	3	PD, CCH	5	150	30/15/0	105	E							5		
GPH489	Processing and interpretation of seismic data	3	PD, CCH	5	150	30/15/0	105	E							5		
GPH490	Static modeling of geological enviroments based on Seismic Data	3	PD, CCH	5	150	30/15/0	105	E							5		
GPH491	Forecasting of seismoacoustic models and types of geologi-cal section based on seismic data	4	PD, CCH	4	120	30/15/0	75	E							4		
GPH492	The methodology of mapping a geological section	4	PD, CCH	4	120	30/15/0	75	E							4		
GPH493	Introduction to geological section prediction based on seismic data	4	PD, CCH	4	120	30/15/0	75	E							4		
M-10. Module of final attestation																	
ECA103	Final examination		FA	8											8		
Additional type of training (ATT)																	
AAP500	Military training																

Total based on UNIVERSITY:	31	29	28	32	30	30	33	27	
	60		**60**		**60**		**60**		

Number of credits for the entire period of study

Cycle code	Cycles of disciplines	Credits			
		Required component (RC)	University component (UC)	Component of choice (CCH)	Total
GED	Cycle of general education disciplines	51	0	5	56
BD	Cycle of basic disciplines	0	82	30	112
PD	Cycle of profile disciplines	0	24	40	64
Total for theoretical training:		**51**	**106**	**75**	**232**
FA	Final attestation				8
TOTAL:					**240**

Decision of the Educational and Methodological Council of KazNRTU named after K.Satpayev. Minutes № 3 dated 20.12.2024

Decision of the Academic Council of the Institute. Minutes № 3 dated 28.11.2024

Signed:

Governing Board member - Vice-Rector for Academic Affairs	Uskenbayeva R. K.
Approved:	
Vice Provost on academic development	Kalpeyeva Z. Б.
Head of Department - Department of Educational Program Management and Academic-Methodological Work	Zhumagaliyeva A. S.
Director - Geology and Oil-gas Business Institute named after K. Turyssov	Auyelkhan Y. .
Department Chair - Geophysics and seismology	Ratov B. T.
Representative of the Academic Committee from Employers ____Acknowledged____	Uzbekov N. B.