**NJSC “Kazakh National Research Technical University named after K.I. Satbayev”**
**Institute “Institute of Geology and Oil-Gas Business named after K. Turyssov”**
**Department "Geological survey, prospecting and exploration of mineral deposits"**

# EDUCATIONAL PROGRAM

# «GEOLOGY AND EXPLORATION OF SOLID MINERAL DEPOSITS»

**Doctor of Philosophy PhD in the educational program " 8D07205 Geology and exploration of solid mineral deposits"**

1st edition
in accordance with the State Educational Standard of Higher Education 2018

**Almaty 2021**

**The program is drawn up and signed by the parties:**

**From KazNRTU after K.Satpaev:**
1. Head of GSPaEMD department А.А. Бекботаева
2. Director of K.Turysov IGOaM А.Х. Сыздыков
3. Chairman of department's UMG, professor А.Б. Байбатша

**From employers:**
1. Chief Researcher of the Institute of Geological Sciences named after KI Satpayev, Candidate of Geological and Mineralogical Sciences Zhunusov A.A.
2. Director of LLP "ECC" GEO ", full member of PONEN – B.M. Kabaziev
3. Head of the geological prospecting site Pustynnoe JSC "AK Altynalmas", candidate of geological and mineralogical sciences Rassadkin V.V.

**From partner university:**
Professor of the Department of Geology of the Engineering School of Natural Resources of the Tomsk Polytechnic University, Doctor of Geological and Mineralogical Sciences Yazikov E.G.

Approved at a meeting of the Academic Council of the Kazakh National Research Technical University named after K.I. Satpayev. Minutes No. 3 dated June 25, 2021.

**Qualification:**
Level 8 National framework of qualifications:
8M07 Engineering, manufacturing and construction industries
8M072 Manufacturing and processing industries (master):
Geology and exploration of solid mineral deposits

**Professional competence:** Managing the geological industry, organizing, conducting and monitoring geological exploration at all stages and stages of geological research, being an expert in geology and exploration of subsoil, the state and prospects for the development of the industry, the legal framework for subsoil use, as well as requirements for the quality of mineral raw materials and market conditions global, regional and local markets, an expert in research work in the field of prospecting, exploration, exploitation of solid mineral deposits, teaching skills for work in universities, research competencies for working on projects in research institutes

**Brief description of the program:**

It is intended for the implementation of scientific and pedagogical training of doctors on the educational program "Geology and Exploration of Solid Mineral Deposits" at Satbayev University and developed within the framework of the direction "Manufacturing and Processing Industries".

*1. The goal of the educational program* of doctoral studies "Geology and exploration of solid mineral deposits" is to achieve high quality postgraduate professional education in compliance with the mandatory requirements for the level of training of doctoral students; stimulation of independent educational, research and professional activities of doctoral students. The educational program for the preparation of a PhD doctor has a scientific and pedagogical focus and involves fundamental educational, methodological and research training and in-depth study of disciplines in the relevant areas of science for the system of higher and postgraduate education and the scientific sphere.

At the doctoral level, training in the specialty "Geology and Exploration of Solid Mineral Deposits" is carried out along trajectories that involve the implementation of educational programs for the training of personnel in the geological sector with in-depth technical and analytical, scientific, pedagogical and predictive training.

*2. Labor activities:*

- research;
- production and technological;
- organizational and managerial,
- pedagogical.

Doctor in the specialty "Geology and exploration of solid mineral deposits", depending on the type of professional activity, is prepared to solve the following professional tasks:

*a. research activities:*

- independent choice and justification of the goals and objectives of scientific research;
- independent selection and development of methods for solving the assigned tasks during field, laboratory, interpretation studies using modern equipment, instruments and information technologies (in accordance with the direction (profile) of the master's program);
- analysis and generalization of the results of research works using modern achievements of science and technology, advanced Kazakhstani and foreign experience;
- evaluation of the results of research works, preparation of scientific reports, publications, reports, drawing up applications for inventions and discoveries;

*b. production and technological activities:*

- independent preparation and implementation of industrial and scientific-industrial field, laboratory and interpretation studies in solving practical problems (in accordance with the direction (profile) of the master's program);

- independent selection, preparation and professional operation of modern field and laboratory equipment and instruments (in accordance with the direction (profile) of the master's program);

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

- complex processing and interpretation of field and laboratory information in order to solve scientific and production problems;

- determination of the economic efficiency of scientific and industrial work;

*c. organizational and management activities:*

- planning and organization of research and production field, laboratory and interpretation work;

- planning and organization of scientific and research and production seminars and conferences;

*d. pedagogical activity:*

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

- participation in the management of scientific and educational work of students and undergraduates in the field of geology.

*3. Objects of the graduate's professional activity:*

- land, crust, lithosphere, rocks, deposits of solid minerals;
- physical properties of rocks;
- minerals, crystals, geochemical fields and processes;
- geological environment, natural and technogenic geological processes; ecological functions of the lithosphere.

# PASSPORT OF THE EDUCATIONAL PROGRAM

## 1 Scope and content of the program

The educational program for the preparation of a Doctor of Philosophy (PhD) has a scientific and pedagogical focus and involves fundamental educational, methodological and research training and in-depth study of disciplines in the relevant areas of science for the system of higher and postgraduate education and the scientific sphere.

The educational program for the preparation of a doctor in the profile assumes fundamental educational, methodological and research training and in-depth study of disciplines in the relevant areas of science for the branches of the national economy, the social sphere: education, medicine, law, art, economics, business administration and in the field of national security and military affairs.

Educational programs for doctoral studies in terms of vocational training are developed on the basis of studying the experience of foreign universities and research centers that implement accredited training programs for PhD doctors or doctors by profile.

The content of the educational program of specialized doctoral studies is established by the university independently.

The main criterion for the completeness of the educational process for the preparation of doctors of philosophy (PhD) (doctor in the profile) is the mastering of at least 180 academic credits by a doctoral student, including all types of educational and scientific activities.

The department of SPiRMPI, which implements the educational program of doctoral studies "Manufacturing and processing industries", has agreements on cooperation in the field of education and science with foreign universities and research centers implementing accredited educational programs for doctoral studies

The term of study in doctoral studies is determined by the amount of acquired academic credits. Upon mastering the established amount of academic credits and achieving the expected learning outcomes for obtaining a PhD or profile, the doctoral education program is considered fully mastered.

The training of personnel in doctoral studies is carried out on the basis of educational master's programs in two areas:

1) scientific and pedagogical with a training period of at least three years;

2) specialized with a training period of at least three years.

The content of the EP "Geology and Exploration of Solid Mineral Deposits" on the basis of the development of a multi-level system of personnel training, the fundamentality and quality of education, the continuity and continuity of education and science, the unity of education, upbringing, research and innovation, aimed at maximum satisfaction of consumers' needs, should ensure:

- obtaining a full-fledged and high-quality professional and scientific and pedagogical education in the field of geology, confirmed by the level of knowledge and skills, skills and competencies, their assessment, both in content and in volume

- ensuring the training of doctors for the geological industry, who know the technology, organization and economics of the geological industry, methods and principles of its improvement and design.

- training of professional and competitive specialists in the field of geology, prospecting and exploration of mineral resources;

- high level of language training;

- development of skills in design and research activities, implementation of projects aimed at the practical application of modern professional digital techniques and technologies for organizing the activities of geological production enterprises, research and educational organizations;

- the optimal ratio in the educational process of theoretical and practical training (due to the purposeful organization of research and production practices);

- a personality-oriented approach to the educational process, focused on developing a responsible attitude to the results of their professional activities;

- the aspect of self-development, where the emphasis is placed on the organization of professional activities, within which the master's student is focused on continuous professional self-improvement.

The structure of the educational program of doctoral studies contains two equivalent components: educational and scientific, which determine the content of education, and reflects their ratio, measurement and accounting.

The doctoral educational program contains:

- theoretical training, including the study of a cycle of basic and major disciplines;

- professional practice;

- scientific research (experimental research) work, including the implementation of a doctoral dissertation;

- interim and final certification.

Accounting for the labor intensity of all types of work is carried out according to the volume of mastered material and is measured in loans. At the same time, an accumulative credit system operates, taking into account loans disbursed at previous levels of education.

**Objectives of the educational program:**

- The readiness of specialists for research and design work in the field of geology.

- The readiness of specialists to search for and receive new information necessary to solve professional problems in the field of knowledge integration in relation to their field of activity, to actively participate in the activities of an enterprise or organization.

- The readiness of specialists for scientific and informational, problematic communications in a professional environment, to engage in organizational, managerial and research activities, to be aware of the responsibility for making their professional decisions.

- The readiness of specialists for self-study and continuous professional development throughout the entire period of scientific or professional activity.

## 2 Requirements for applicants

Persons with a Master's degree and work experience of at least 1 (one) year or who have completed residency training are admitted to doctoral studies.

Enrollment in the number of doctoral students is carried out by the admissions committees of universities and scientific organizations based on the results of the entrance examination for groups of doctoral studies and a certificate confirming proficiency in a foreign language in accordance with the common European competences (standards) of foreign language proficiency.

When enrolling in universities, doctoral students independently choose an educational program from the corresponding group of educational programs.

The enrollment of persons for the targeted training of doctors of philosophy (PhD) under the state educational order is carried out on a competitive basis.

The procedure for admitting citizens to doctoral studies is established in accordance with the "Standard rules for admission to training in educational organizations that implement educational programs of postgraduate education."

The formation of the contingent of doctoral students is carried out by placing a state educational order for the training of scientific and pedagogical personnel, as well as paying for training at the expense of citizens' own funds and other sources. The state provides citizens of the Republic of Kazakhstan with the right to receive, on a competitive basis, in accordance with the state educational order, free postgraduate education, if they receive education of this level for the first time.

At the "entrance" the doctoral student must have all the prerequisites necessary for mastering the relevant professional doctoral curriculum. The list of required prerequisites is determined by the higher education institution independently.

In the absence of the necessary prerequisites, the doctoral student is allowed to master them on a paid basis. In this case, doctoral studies begin after the doctoral student has fully mastered the prerequisites.

## 3 Requirements for Completion and Diploma

Persons who have mastered the educational program of doctoral studies and defended their doctoral dissertation, with a positive decision of the dissertation councils of a university with a special status or the Committee for Control in the Field of Education and Science of the Ministry of Education and Science of the Republic of Kazakhstan, based on the results of the examination, are awarded the degree of Doctor of Philosophy (PhD) or Doctor of Science in profile and issued a state diploma with an attachment (transcript).

Persons who have received a PhD degree, to deepen scientific knowledge, solve scientific and applied problems on a specialized topic, carry out a postdoctoral program or conduct research under the guidance of a leading scientist chosen by the university.

3.1 Requirements for key competencies of doctoral graduates:

*1) have an idea:*

- about the main stages of development and the change of paradigms in the evolution of science;
- on the subject, ideological and methodological specifics of the natural (social, humanitarian, economic) sciences;
- about scientific schools of the relevant branch of knowledge, their theoretical and practical developments;
- on the scientific concepts of world and Kazakh science in the relevant field;
- on the mechanism of implementation of scientific developments in practice;
- about the norms of interaction in the scientific community;
- about the pedagogical and scientific ethics of the scientist-researcher;

*2) know and understand:*

- modern trends, directions and patterns of development of domestic science in the context of globalization and internationalization;
- methodology of scientific knowledge;
- achievements of world and Kazakh science in the relevant field;
- (to understand and accept) the social responsibility of science and education;
- perfect foreign language for scientific communication and international cooperation;

*3) be able to:*

- organize, plan and implement the process of scientific research;
- analyze, evaluate and compare various theoretical concepts in the field of research and draw conclusions;
- analyze and process information from various sources;

- to carry out independent scientific research, characterized by academic integrity, based on modern theories and methods of analysis;
- generate your own new scientific ideas, communicate your knowledge and ideas to the scientific community, expanding the boundaries of scientific knowledge;
- to choose and effectively use modern research methodology;
- plan and predict your further professional development;

*4) have skills:*

- critical analysis, assessment and comparison of various scientific theories and ideas;
- analytical and experimental scientific activities;
- planning and forecasting research results;
- oratory and public speaking at international scientific forums, conferences and seminars;
- scientific writing and scientific communication;
- planning, coordination and implementation of research processes;
- a systematic understanding of the field of study and demonstrate the quality and effectiveness of the selected scientific methods;
- participation in scientific events, fundamental scientific domestic and international projects;
- leadership management and team leadership;
- responsible and creative attitude to scientific and scientific-pedagogical activities;
- conducting patent search and experience in transferring scientific information using modern information and innovative technologies;
- protection of intellectual property rights to scientific discoveries and developments;
- free communication in a foreign language;

*5) be competent:*

- in the field of scientific and scientific-pedagogical activity in conditions of rapid renewal and growth of information flows;
- in carrying out theoretical and experimental scientific research;
- in the formulation and solution of theoretical and applied problems in scientific research;
- in conducting a professional and comprehensive analysis of problems in the relevant area;
- in matters of interpersonal communication and human resource management;
- in matters of university training of specialists;
- in the examination of scientific projects and research;
- in ensuring constant professional growth.

3.2 Requirements for research and development of a student under the PhD program:

1) compliance with the main problems of the educational program of doctoral studies, on which the doctoral dissertation is being defended;

2) is relevant and contains scientific novelty and practical significance;

3) is based on modern theoretical, methodological and technological achievements of science and practice;

4) is based on modern methods of data processing and interpretation using computer technology;

5) carried out using modern scientific research methods;

6) contains scientific research (methodological, practical) sections on the main protected provisions.

3.3 Requirements for organizing practices:

The practice is carried out with the aim of developing practical skills in scientific, scientific, pedagogical and professional activities.

The educational program of doctoral studies includes:

1) teaching and research practice - for students of the Ph.D. program;

2) industrial practice - for students under the program of specialized doctoral studies.

During the period of pedagogical practice, doctoral students, if necessary, are involved in conducting classes in undergraduate and graduate programs.

The research practice of a doctoral student is carried out with the aim of studying the latest theoretical, methodological and technological achievements of domestic and foreign science, as well as consolidating practical skills, applying modern research methods, processing and interpreting experimental data in the dissertation research.

The industrial practice of a doctoral student is carried out in order to consolidate the theoretical knowledge gained in the learning process and improve the professional level.

The content of research and industrial practice is determined by the topic of the doctoral dissertation.

# 4 Working curriculum of the educational program

4.1.

MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF KAZAKHSTAN
KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY after K. SATBAYEV

SATBAYEV UNIVERSITY

APPROVED
Chairman of the Board-
Rector of the KazNRTU after K.Satbayev
M.M. Begentayev
"__" 06 2021

WORKING CURRICULUM
of the educational program for 2021-2022 academic year admission
Educational program 8D07205 - "Geology and exploration of solid mineral deposits"
Group of Educational programs M121 - "Geology"

Full-time study Study duration: 3 years Academic degree: Doctor of Philosophy (PhD)

| year of study | Code | Name of course | Component | Academic credits | Total hours | audience volume, lec/ lab/ pr | SIW (including SIWT) in hours | Prerequisites | Code | Name of course | Component | Academic credits | Total hours | audience volume, lec/ lab/ pr | SIW (including SIWT) in hours | Prerequisites |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 semester | | | | | | | | 2 semester | | | | | | | |
| 1 | MET322 | Research methods | BD IC | 5 | 150 | 2/0/1 | 105 | | AAP345 | Doctoral student research work, including internships and doctoral dissertations | DSRW | 24 | | | | |
| | LNG305 | Academic writing | BD IC | 5 | 150 | 2/0/1 | 105 | | AAP350 | Pedagogical practice | BD | 10 | | | | |
| | 1201 | Electives | PS OC | 5 | 150 | 2/0/1 | 105 | | | | | | | | | |
| | 1301 | Electives | PS OC | 5 | 150 | 2/0/1 | 105 | | | | | | | | | |
| | 1302 | Electives | PS OC | 5 | 150 | 2/0/1 | 105 | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | In total | | 25 | | | | | | In total | | 34 | | | | |
| | 3 semester | | | | | | | | 4 semester | | | | | | | |
| 2 | AAP345 | Doctoral student research work, including internships and doctoral dissertations | DSRW | 24 | | | | | AAP346 | Doctoral student research work, including internships and doctoral dissertations | DSRW | 25 | | | | |
| | AAP355 | Research scientific training | PS | 10 | | | | | | | | | | | | |
| | | In total | | 34 | | | | | | In total | | 25 | | | | |
| | 5 semester | | | | | | | | 6 semester | | | | | | | |
| 3 | AAP346 | Doctoral student research work, including internships and doctoral dissertations | DSRW | 25 | | | | | AAP346 | Doctoral student research work, including internships and doctoral dissertations | DSRW | 25 | | | | |
| | | | | | | | | | ECA303 | Writing and defending doctoral dissertation | FA | 12 | | | | |
| | | In total | | 25 | | | | | | In total | | 37 | | | | |
| | | | | | | | | | | In all | | 180 | | | | |

Decision of the Academic Board of KazNRTU after K.Satbayev. Protocol No. 3 of "25" 06 2021.

Decision of the Academic Board of the Institute GPMI. Protocol No. 5 of "24" 12 2020.

Vice-rector for academic affairs B. Zhautikov

Director of the Institute A. Syzdykov

Head of the Department A. Bekbotayeva

| Number of credits for the whole period of study | |
|---|---|
| **Cycles of disciplines** | **Credits** |
| The cycle of general education | 0 |
| A cycle of basic disciplines ( BD IC, BD OC) | 25 |
| A cycle of profile disciplines (PD IC, PS OC) | 20 |
| **All on the theoretical classes:** | **45** |
| DSR .. | 123 |
| Writing and defending doctoral dissertation | 12 |
| **In all:** | **180** |

СӘТБАЕВ УНИВЕРСИТЕТІ SATBAYEV UNIVERSITY

MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF KAZAKHSTAN
KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY after K. SATBAYEV

APPROVED
Director of the Institute of Geology,
petroleum and mining engineering
_____ A. Syzdykov
«28» 06 2021.

**CATALOG OF DISCIPLINES FOR ELECTION BY DOCTORANT enrolment for 2021 - 2022 academic year**

Educational program 8D07205 - "Geology and exploration of solid mineral deposits"
Group of Educational programs M121 - "Geology"

Term of study: 3 years

| Optional components - 15 credits | | | | | | | |
|---|---|---|---|---|---|---|---|
| Elective code | Discipline code | Name of disciplines | Academic credits | Total hours | lec/ lab/ pr | SIW (including SIWT) in hours | semester |
| 1201 | GEO209 | Geological modeling of mineral deposits | 5 | 150 | 2/0/1 | 105 | 1 |
| | GEO218 | Mineral deposits of Kazakhstan | 5 | 150 | 2/0/1 | 105 | 1 |
| | GEO306 | Petrochemistry | 5 | 150 | 2/1/0 | 105 | 1 |
| | GEO240 | Regional geology of the UIC | 5 | 150 | 2/0/1 | 105 | 1 |
| 1301 | GEO231 | Basics of petrology | 5 | 150 | 2/0/1 | 105 | 1 |
| | GEO214 | Advanced well logging | 5 | 150 | 1/0/2 | 105 | 1 |
| | GPH211 | GIS uranium deposits | 5 | 150 | 2/1/0 | 105 | 1 |
| | GEO301 | Geology and mineralogy of noble metals deposits | 5 | 150 | 2/0/1 | 105 | 1 |
| | GEO302 | Geology and mineralogy of the rare metals deposits | 5 | 150 | 2/0/1 | 105 | 1 |
| | GEO303 | Geology and mineralogy of the deposits of non-ferrous metals | 5 | 150 | 2/0/1 | 105 | 1 |
| | GEO304 | Geology and mineralogy of the deposits of ferrous metals | 5 | 150 | 2/0/1 | 105 | 1 |
| 1302 | GEO210 | Geological support of subsoil use | 5 | 150 | 2/0/1 | 105 | 1 |
| | GEO220 | Metallogeny and ore formations of Kazakhstan | 5 | 150 | 2/0/1 | 105 | 1 |
| | GEO305 | Volumetric modeling and predictive evaluation of mineral deposits | 5 | 150 | 2/1/0 | 105 | 1 |
| | | Total: | 15 | | | | |

**Head of the Department** **A. Bekbotayeva**

## 5 Descriptors of the level and amount of knowledge, abilities, skills and competencies

The third level descriptors within the Comprehensive Qualifications Framework of the European Higher Education Area (EC-EHEA) reflect learning outcomes that characterize the student's abilities:

1) demonstrate a systematic understanding of the field of study, mastering the skills and research methods used in the field of geology, prospecting, exploration of mineral deposits;

2) demonstrate the ability to think, design, implement and adapt the essential research process with a scientific approach;

3) contribute with their own original research to expand the boundaries of the scientific field, which deserves publication at the national or international level;

4) critically analyze, evaluate and synthesize new and complex ideas;

5) communicate their knowledge and achievements to colleagues, the scientific community and the general public;

6) to promote, in an academic and professional context, the technological, social or cultural development of a knowledge-based society.

## 6 ECTS Diploma Supplement

The application was developed according to the standards of the European Commission, Council of Europe and UNESCO / CEPES. This document is for academic recognition only and is not an official proof of education. Not valid without a university degree. The purpose of completing the European Supplement is to provide sufficient information about the holder of the diploma, the qualification obtained, the level of this qualification, the content of the study program, the results, the functional purpose of the qualification, as well as information about the national education system. The application model that will be used to translate grades uses the European Credit Transfer or Transfer System (ECTS).

The European Diploma Supplement provides an opportunity to continue education at foreign universities, as well as to confirm national higher education for foreign employers. When going abroad for professional recognition, additional legalization of the educational diploma is required. The European Diploma Supplement is completed in English upon individual request and is issued free of charge.

**Research methods**
CODE - MET322
CREDIT - 5 (2/0/1/2)
PREREQUISIT: no

PURPOSE AND OBJECTIVES OF THE COURSE
The purpose of studying this discipline is to gain knowledge on the basic theoretical provisions, technologies, operations, practical methods and techniques for conducting scientific research on the basis of modern achievements of domestic and foreign scientists and to master the skills of choosing a topic for scientific research, scientific research, analysis, experimentation, data processing, obtaining justified effective decisions using information technology.

BRIEF DESCRIPTION OF THE COURSE
The course includes: the concept of science and scientific research, methods and methodology of scientific research, methods of collecting and processing scientific data, principles of organizing scientific research, methodological features of modern science (differentiation, integration, systems approach, abstraction, concretization, synergetic paradigm, evolutionism , logic, instrumental analysis, etc.), ways of developing science and scientific research, the role of technical sciences, informatics and engineering research in modern science, the structure of technical sciences, the use of general scientific, philosophical and special methods (including marketing and investment) scientific research in theory and practice.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
As a result of mastering the discipline, the student:
1. must know: the specifics of choosing the direction of scientific research and the stages of its implementation; tasks and methods of theoretical research; classification, types and objectives of experimental research; information support of scientific research;
2. must be able to: analyze the trends of modern science, determine promising directions of scientific research in the subject area of professional activity, the composition of research works, which determine their factors; use experimental and theoretical research methods in professional activities; to adapt modern achievements of science and science-intensive technologies to the educational and self-educational process; work with natural science literature of different levels (popular science publications, periodicals), including in foreign languages.

**Academic writing**
CODE - LNG305
CREDIT - 5 (2/0/1/2)
PREREQUISIT: no

PURPOSE AND OBJECTIVES OF THE COURSE
The course is aimed at teaching the ability to express and substantiate your thoughts through a short but well-reasoned scientific text. Doctoral students will be introduced to the necessary concepts, terms and modern concepts of the basic principles of creating written academic texts.
This course is designed to help doctoral students acquire the skills of working with information in writing in scientific databases, the practical writing of an author's scientific text, a qualified assessment of one's own and someone else's scientific text of a different genre, will allow them to carry out professional activities related to the analysis and abstracting of texts, work with different genres. academic writing.

BRIEF DESCRIPTION OF THE COURSE
Particular attention is paid to the basic requirements for scientific texts of various genres, the development of the technique of preparation, design, composition and argumentation in written academic texts, the formation of the skills of the author's writing of analytical abstracts, reports, theses, articles, dissertations, editing of scientific text.
The approaches to working with scientific information that have developed in seismology, geology and geophysics, principles, rules, norms of preparation, writing, editing of an academic text for the purpose of public presentation of scientific results of theoretical, empirical and applied levels are considered.
Much attention will be paid to the analysis of the structure, construction, composition and style of a scientific text, practical skills in writing written texts of an academic nature.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
As a result of mastering the program, undergraduates must:
Know: grammatical phenomena necessary for writing, translation and editing; complex syntactic constructions of scientific and business speech; technology of structuring academic text; features of the scientific style of written texts; principles of organizing scientific texts; vocabulary representing a neutral scientific style, business writing structure; basic terms, concepts and categories of the language of the specialty; different ways to hypothesize and build evidence.

**Geological modeling of mineral resources**
CODE - GEO209
CREDIT - 5 (2/1/0/2)
PREREQUISIT: no

PURPOSE AND OBJECTIVES OF THE COURSE
The purpose of studying this discipline is to acquire knowledge, skills and abilities to work with software for three-dimensional geological modeling and assessment of mineral reserves. To give theoretical and practical knowledge in the field of computer modeling of deposits: in relation to the tasks of geology. Deepening technological education in the field of computer technology.

BRIEF DESCRIPTION OF THE COURSE
Introduction. The emergence of the need for computer programs for visualization and interpretation of various geological exploration data in a 3D environment. 3D modeling of mineral deposits. Working with graphic applications. Field modeling and reserves estimation with Micromine software.
KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
Know: methods and basic principles of geological modeling of mineral deposits in relation to the problems solved in geology;
Be able to: on the basis of primary geological materials, interpret and create wireframe, block models of ore bodies; build digital surface models (DMP); visualize interpreted geological, geochemical, etc.
Have the skills to: apply GIS technologies to solve geological and appraisal works of minerals; estimate ore reserves using various methods of the Micromine program.

**Mineral deposits of Kazakhstan**
CODE - GEO218
CREDIT - 5 (2/0/1/2)
PREREQUISIT: General Geology

PURPOSE AND OBJECTIVES OF THE COURSE
The main task of the discipline is to obtain general information about mineral deposits in Kazakhstan, methods of their development, principles of mineral processing, etc.

BRIEF DESCRIPTION OF THE COURSE
State and prospects for the development of the mineral resource base of the Republic of Kazakhstan. Metallic minerals. Iron deposits. Manganese deposits. Deposits of chromium, titanium, vanadium. Deposits of copper. Deposits of lead and zinc. Deposits of aluminum, nickel, cobalt. Deposits of tungsten, molybdenum, tin. Deposits of tantalum, niobium, zirconium, rare earth elements. Deposits of noble metals (gold, silver). Deposit of radioactive metals. Uranium deposits. Non-metallic minerals. Deposits of building materials.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
Know: Basic concepts and definitions of mineral deposits; basic concepts used to characterize different series of deposits; Basic minerals
Be able to: Analyze data; apply different approaches to data processing, Separate ore and vein minerals; Draw up a description of the deposit; Basic minerals
Have skills: Methods for determining minerals, rocks; Skills of working with geological literature on mineral deposits of various types; Skills in working with information sources on mineral deposits of various types; Skills in working with geological, technical and legal documentation; Skills in working with information sources on mineral deposits of various types

**Petrochemistry**
CODE - GEO 306
CREDIT - 5 (2/1/0/2
PREREQUISIT: GEO122 Petrography

PURPOSE AND OBJECTIVES OF THE COURSE
The purpose of studying this discipline is to give doctoral students knowledge about the chemical composition of various types of rocks and methods of their petrochemical studies. The chemical composition of rocks is an essential feature for determining the rocks themselves and their formation.

SHORT DESCRIPTION OF THE COURSE
Discipline "Petrochemistry" and its tasks. Petrochemical method of recalculations according to A.N. Zavaritsky for magmatites and charting and analysis of research results. Methods for studying the chemical composition of metamorphites according to A.D. Rakcheev, D. Shaw and A. Kudo, P. Niggli and charting and defining protoliths. Study of the chemical composition of metasomatites by the oxygen method of T. Bart and by the atomic-volumetric method by V.A. Mine, charting and analysis of research results.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
Know: about the chemical composition of various types of rocks and methods of their study
Be able to: learn to conduct petrochemical research for the implementation of doctoral dissertations.
Have skills: they will be able to independently analyze petrochemical data. Choose the necessary research and data processing methodology, draw up diagrams.

**Regional geology of the CIS countries**
CODE - GEO240
CREDIT - 5 (2/0/1/2)
PRE-REQUISIT:no

PURPOSE AND OBJECTIVES OF THE COURSE
Acquaintance with the peculiarities of the geological structure, the history of geological development, the patterns of distribution of mineral deposits and their geological position in the earth's crust of the vast territory occupied by the neighboring countries (CIS and Baltic states). The study of this discipline significantly expands the professional horizons of future geologists, which will help them to successfully use the knowledge gained within the framework of this course in their professional activities in the study of geology and conducting prospecting and exploration of mineral deposits. Knowledge of the features of the geological structure of the territory of countries located in the vicinity of the republic will enable students to conduct a comparative study of the tectonic structures of the republic with neighboring ones and better solve professional problems in establishing patterns of development of structures of various ranks and the distribution of mineral deposits in them.

SHORT DESCRIPTION OF THE COURSE
Fundamentals of tectonic zoning of the territory of the CIS and Baltic countries. Ancient platforms: East European platform, Siberian platform. Fold areas of the Ural-Mongolian belt: Ural-Novaya Zemlya fold area, South Tien Shan. Kazakh-Kyrgyz folded region, Zaysan folded system, Altai-Sayan folded region, Sayan-Yenisei folded region. Baikal and Transbaikalia. Taimyr-Severozemelskaya region. Young Epipaleozoic plates of Eurasia: Scythian and Turanian plates, West Siberian plate. Areas of the Mediterranean belt of Cenozoic (alpine) folding within Europe: the Eastern Carpathians and the Mountainous Crimea, the Caucasian mountainous region. Areas of the Mediterranean belt of Cenozoic (alpine) folding within Asia: Kopetdag and Pamir. Areas of the Pacific belt of Mesozoic and Cenozoic (alpine) folding: Verkhoyansk-Chukotsak and Kamchatka-Koryak regions. Areas of the Pacific belt of Cenozoic (Alpine) folding: Mongol-Okhotsk, Sikhote-Alin and Sakhalin folded regions of the Far East of Russia. Kuril and Commander Islands.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
Know: regional structures of the earth's crust of the studied area in four positions: the principle of tectonic zoning of regional structures; the boundaries of each considered structure; know the features of the geological structure of the structure in terms of its stratigraphy and tectonics (history of development); highlight mineral structures.
Be able to: analyze a tectonic map and a tectonic zoning map.

Have skills: analysis, comparison of geological data of one territory with another, to reproduce the history of the geological development of the region and the allocation of structures and associated types of mineral deposits.

**Fundamentals of Petrology**
CODE - GEO231
CREDIT - 5 (2/0/1/2)
PREREQUISIT: GEO122 Petrography

PURPOSE AND OBJECTIVES OF THE COURSE
Most of the endogenous deposits are closely associated with magmatites and they themselves are often minerals. Therefore, for undergraduates of the specialty "Geology and exploration of mineral resources" the main goal of studying this discipline is to gain knowledge about the composition, structure, conditions of formation of magmatites and the relationship with them of mineral deposits.

SHORT DESCRIPTION OF THE COURSE
Modern data on magmas and their origin: physicochemical foundations of crystallization of magmatic melts; the main reasons for the variety of magmatites; chemical and mineral composition, magmatite structures and their genetic significance; rocks of ultramafic, basic, medium, acidic, foidic compositions and their types, varieties, conditions of formation and connection with it of mineral deposits; examining them using a polarizing microscope; magmatic associations (formations) and series.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
Know: about the patterns of formation and crystallization of magmatic melts, modern classification and nomenclature, chemical and mineral composition, structure and genesis of the main types and varieties of magmatites.
Be able to: analyze the chemical composition of rock-forming minerals, restore the conditions for the formation of magmatic rocks, make an assumption about the thermodynamic, chemical and physical conditions of crystallization of rocks.
Have skills: study rock-forming minerals using a polarizing microscope.

**Well Logging (Advanced)**
CODE - GEO214
CREDIT - 5 (2/0/1/2)
PREREQUISIT: no

PURPOSE AND OBJECTIVES OF THE COURSE
The purpose of the course is to acquaint master students with the current state of the borehole
geophysics and modern methods of interpretation of data from geophysical studies of various types of wells.
Objectives of the course: to provide advanced definitions that characterize and classify modern GIS methods; to acquaint with the physical foundations and the corresponding limitations of modern geophysical methods of well survey; consider the main aspects of metrological support and measurement accuracy of various geophysical methods; give a description of the features of the interpretation of well logs in various types
geological sections

BRIEF DESCRIPTION OF THE COURSE
The course contains an information-cognitive lecture module and practical diagrams of various geophysical methods, both in the form of hard copies for visual analysis, and in digital form for acquaintance with interpretation techniques using examples of demonstration programs. The course focuses on the practical application of downhole modifications of geophysical methods, on the analysis of the conditions of their applicability and natural limitations. A number of typical problems, both purely geophysical and geological, solved by borehole geophysics are considered. The course is applied and serves to understand undergraduates the possibilities of using methods, the problems they solve and the possibilities of their application and development.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
Know: theoretical foundations of geophysical methods; relationships between petrophysical parameters and observed geophysical fields in the well; methods of geological interpretation of well logging data; rational integration of geophysical methods depending on geological and technical conditions and set practical tasks.
Be able to: conduct well logging using various geophysical methods;
- to interpret the results of processing the observed data.
Own: geophysical methods when performing well logging; modern GIS technologies; the skills of collecting, analyzing and using information necessary for making various management decisions.

**GIS of uranium deposits**
CODE - GEO211
CREDIT - 5 (1/0/2/2)
PREREQUISIT: General Geology

PURPOSE AND OBJECTIVES OF THE COURSE
The main goal of the course is to familiarize the undergraduate with the theoretical and geological foundations of methods for controlling the development of mineral resources, the possibility of using methods of geophysical research to solve geological and geophysical problems in the construction and operation of oil and gas fields, as well as for production, technological, experimental research, design activities

BRIEF DESCRIPTION OF THE COURSE
Determination of parameters of productive strata and wells by geophysical methods; formation of students 'theoretical foundations of methods of field geophysical research, development of students' ability to implement the acquired skills of conducting independent geophysical surveys of wells and reservoirs; planning, carrying out and interpretation of the obtained results of geophysical studies for further application.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
The necessary conditions for mastering the discipline are:
Knowledge: the main indicators of the development of hydrocarbon deposits; the main properties of rocks; the basics of GIS data interpretation; the main instruments and equipment used in the conduct of geophysical research.
Ability: to use instruments and equipment for geophysical surveys of wells and reservoirs; interpret the results of geophysical studies of wells and reservoirs; determine the effectiveness of various GIS methods for solving specific operational and technical problems; to give recommendations on adjusting the well operation mode based on well logging data.
Possession: methods of calculating the main technological indicators in the development of oil and gas fields; skills in conducting independent research of wells and reservoirs; the method of determining the composition of the fluid in the wellbore by the skills of scientific research.

**Geology and mineralogy of precious metal deposits**
CODE - GEO 301
CREDIT - 5 (2/0/1/2)
PREREQUISIT: Crystallography and Mineralogy

PURPOSE AND OBJECTIVES OF THE COURSE
Obtaining the most complete knowledge about the leading geological and industrial gold deposits based on the use of all available geological data in conjunction with detailed microscopic studies of these objects.

SHORT DESCRIPTION OF THE COURSE
Geological characteristics of various geological and industrial types of noble deposits. The main types of ores and productive paragenetic associations of gold for each type of deposits. Typomorphic features of the leading minerals-concentrators of gold and the distribution patterns of the noble metal in them. Microscopic studies of gold-bearing ores, with the establishment of the size of gold particles and the forms of its occurrence. Fine-dispersed ore beneficiation technologies developed by beneficiation technologists and also used for the extraction of so-called invisible gold.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
Know the classification of geological and industrial gold deposits in the world and which among them occupy a leading position in Kazakhstan; productive paragenetic associations and major gold concentrating minerals for each geological-industrial type.
To be able to conduct microscopic studies of gold-bearing ores in order to identify finely dispersed gold and the patterns of its distribution in ores and the main ore-forming minerals.
Acquire skills in using various analytical techniques to study gold-bearing ores. Be competent in the technology of beneficiation of gold ores, especially those containing gold particles at the micro- and nanoscale boundary.

**Geology and mineralogy of rare metal deposits**
CODE - GEO 302
CREDIT - 5 (2/0/1/2)
PREREQUISIT: Crystallography and Mineralogy

PURPOSE AND OBJECTIVES OF THE COURSE
study of the geology of deposits of rare metals, with the involvement of mineraphic studies of ores. Microscopic studies of ores will make it possible to reveal microparagenetic associations of minerals with a set of rare minerals characteristic of each deposit, which will make it possible to distinguish their characteristic mineralogical and geochemical features.

SHORT DESCRIPTION OF THE COURSE
The following topics are included for the study of the subject: study of the mineral composition of the ores of the deposits; determination of the types of ores and their constituent paragenetic associations; determination of zoning in the placement of types of ores; study of the main ore-forming minerals and their typomorphic features; identification of patterns of distribution of valuable components; study of textures and structures of ores; drawing up a diagram of the mineral formation process.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
The knowledge gained from the study of rare metal deposits will allow the researcher to: independently determine the microscopic mineral composition of ores, with a detailed study of accessory minerals.
Based on the identified types of ores and their constituent parageneses, their relationships, typomorphic properties of minerals, textures and structures of ores, establish the sequence of the ore formation process.
For rare metals, determine productive associations, with the allocation of the main minerals-concentrators of gold and silver and their forms; Find the distinguishing features for each field through a thorough study of the geological position of the field, combined with detailed mineragraphic studies.

**Geology and mineralogy of non-ferrous metal deposits**
CODE - GEO 303
CREDIT - 5 (2/0/1/2)
PREREQUISIT: Crystallography and Mineralogy

PURPOSE AND OBJECTIVES OF THE COURSE
study of the geology of non-ferrous metal deposits, with the involvement of mineraphic studies of ores. Microscopic studies of the ores of non-ferrous metal deposits will reveal microparagenetic associations of minerals with a set of rare minerals characteristic of each deposit, which will make it possible to distinguish characteristic mineralogical and geochemical features for them.

SHORT DESCRIPTION OF THE COURSE
The following topics are included for the study of the subject: study of the mineral composition of the ores of the deposits; determination of the types of ores and their associated paragenetic associations; determination of zoning in the placement of types of ores; study of the main ore-forming minerals and their typomorphic features; identification of patterns of distribution of valuable components; study of textures and structures of ores; drawing up a diagram of the mineral formation process.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
The knowledge gained from the study of non-ferrous metal deposits will allow the researcher: to independently determine microscopically the mineral composition of ores, with a detailed study of accessory minerals.
Based on the identified types of ores and their constituent parageneses, their relationships, typomorphic properties of minerals, textures and structures of ores, establish the sequence of the ore formation process.
For non-ferrous metals, determine productive associations, with the allocation of the main minerals-concentrators of gold and silver and their forms; Find the distinguishing features for each field through a thorough study of the geological position of the field, combined with detailed mineragraphic studies.

**Geology and mineralogy of ferrous metal deposits**
CODE - GEO 304
CREDIT - 5 (2/0/1/2)
PREREQUISIT: Crystallography and Mineralogy

PURPOSE AND OBJECTIVES OF THE COURSE
Have a sufficiently deep knowledge of the deposits of ferrous metals in Kazakhstan. Gaining knowledge about the geology and patterns of distribution of rare metal deposits in the world and in Kazakhstan, their genetic classification, mineralogical and geochemical features based on a detailed microscopic study of rare metal ores.

SHORT DESCRIPTION OF THE COURSE
Geological features of various genetic types of rare metal deposits. Macro- and microscopic characteristics of ores with the identification of the leading types of ores for each genetic type, identification of zoning in their location, their mineral composition, typomorphic features of ore-forming minerals, distribution and forms of occurrence of valuable elements in ores. Mineral formation conditions based on a complex of macro- and microscopic studies of ores.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
To know the geology of various genetic types of rare metal deposits and modern views on their origin. To be able to use traditional and modern methods of studying matter for each type of deposit, taking into account the peculiarities and complexity of their constituent ores. To acquire skills in generalizing the results of microscopic study of ores with data from analytical studies. Have competence in the study of rare metal deposits of various genetic types and be able to use them to build a model of their formation.

**Geological support of subsoil use**
CODE - GEO210
CREDIT - 5 (2/0/1/2)
PREREQUISIT: Fundamentals of Subsoil Use

PURPOSE AND OBJECTIVES OF THE COURSE
know the role and importance of reliable geological data for the effective conduct of a subsoil use operation. Ways and ways to improve the reliability of information about the subsoil. Collection, processing and analysis of information about the subsoil using modern technology. Geographic information systems.

SHORT DESCRIPTION OF THE COURSE
Features of modern subsoil use. Subsoil facilities and subjects. Ownership of subsoil, minerals, mineral raw materials, technogenic mineral formations and geological information on the subsoil. The reliability of geological, hydrogeological, geochemical, geophysical data on the subsoil is the basis for effective modern use of subsoil. Ways and ways to improve the reliability of information about the subsoil. Modern methods of collecting, processing and analyzing information about the subsoil. Geoinformation technology system. State expertise of subsoil. A positive conclusion of the state expertise of information on subsoil, including mineral reserves, is a guarantee of efficient work of subsoil users. Geological support and provision of work on subsoil use of new stages, stages of subsoil use operations is a mandatory, necessary condition for effective use of subsoil. Creation and development of the information system of the state bank of information on subsoil The concept of the development of the geological industry of the Republic of Kazakhstan for the near and distant periods contributes to the degree of reliability of geological support for the operation of modern subsoil use.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
possession of modern methods and methods of geological support and support for subsoil use operations. The ability to preliminarily determine the economic and investment potential of these objects based on the results of the analysis of information about the subsoil of individual regions, the field

**Metallogeny and ore formation of Kazakhstan**
CODE - GEO219
CREDIT - 5 (2/0/1/2)
PREREQUISIT: GEO105 Geology of Mineral Deposits

PURPOSE AND OBJECTIVES OF THE COURSE
The aim of the course is to study the main provisions of general metallogeny and familiarize with the content of regional, historical, special metallogeny for the development of the geological foundations of the mining business, as the fundamental principles of the development of the mineral industry.
The main tasks of studying the discipline are to master the terminology and conceptual base of metallogenic science and the doctrine of ore formations, the principles of metallogenic and ore-formation analysis; get acquainted with the most important types of ore formations and elements of metallogeny of oceans, platforms and folded systems from the point of view of plate tectonics; have an idea of metallogenic zoning of the world, the CIS and Kazakhstan

SHORT DESCRIPTION OF THE COURSE
The concept of metallogeny and minerageny. General metallogeny. The concept of ore-forming processes and systems. The concept of ore formation analysis. Formations are geological, ore, metasomatic and metallogenic. General principles of metallogenic research. Metallogeny of modern seas and oceans, fold-geosynclinal belts. Foundations of metallogeny from the standpoint of modern geodynamics. Metallogeny of rift environments, subduction-orogenic environments, noble metals, non-metallic, ferrous, non-ferrous, radioactive, rare metals in Kazakhstan.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
Know: features of metallogeny and minerageny in the regions of Kazakhstan.
To be able to: analyze the structural diagram of different age formations; draw up a metallogenic map by type of mineral; analyze metallogenic maps.
Have skills: comparison of typical ore and geological formations of Kazakhstan
compilation and analysis of geological and genetic models of typical ore formations in Kazakhstan: iron ore, gold ore, copper ore.

**Volumetric modeling and predictive evaluation of mineral deposits**
CODE - GEO 305
CREDIT - 5 (2/0/1/2)
PREREQUISIT: Geology of Mineral Deposits

PURPOSE AND OBJECTIVES OF THE COURSE
to teach how to build three-dimensional models of a mineral deposit and identify promising areas, find signs of mineralization from the data obtained and visualize the distribution of a useful component over ore bodies, as well as design and estimate ore reserves using GIS "Micromine".

SHORT DESCRIPTION OF THE COURSE
Three-dimensional modeling of mineral deposits is one of the leading methods in forecasting, prospecting, metallogenic and exploration work. Three-dimensional wireframe and block modeling of ore bodies based on factual material provides knowledge about methods of interpretation, interpolation and visualization of geological and geochemical data. Three-dimensional modeling of deposits is based on the preparation of exploration data and their import into the Micromine GIS, as well as geostatistical analysis of data and the construction of digital models of the surface and quarry.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
Know: 3D modeling of mineral deposits; 3D wireframe and block modeling of ore bodies based on actual material; visualization of geological, geochemical data.
Be able to: Using primary geological materials using the Micromine program, learn to create three-dimensional models of the deposit: wireframe, block and digital surface models, as well as design a pit and estimate ore reserves.
Have the skills: Based on the obtained models, they will be able to accurately interpret the data and determine the volume of the ore body, which is an important factor in planning and financing any project.

**Doctoral thesis defense**
THE CODE – ECA303
CREDIT –12

The purpose of the doctoral dissertation is to assess the scientific-theoretical and research-analytical level of the doctoral student, the formed professional and managerial competencies, the readiness to independently perform professional tasks and the compliance of its preparation with the requirements of the professional standard and the educational program of doctoral studies.

SHORT DESCRIPTION
Doctoral dissertation is a scientific work of a doctoral student, which is an independent study, in which theoretical provisions are developed, the totality of which can be qualified as a new scientific achievement, or a scientific problem is solved, or scientifically grounded technical, economic or technological solutions are stated, the implementation of which makes a significant contribution to development the country's economy.
The doctoral dissertation is the result of the research / experimental research work of a doctoral student, carried out during the entire period of study of a doctoral student.
The defense of a doctoral dissertation is the final stage of the master's preparation. A master's thesis must meet the following requirements:

- The topic of the dissertation should be related to priority areas of development of science and / or government programs or programs of fundamental or applied research.
- The content of the thesis, the goals and objectives, the scientific results obtained must strictly correspond to the topic of the thesis.
- The dissertation is carried out in compliance with the principles of independence, internal unity, scientific novelty, reliability and practical value.

## Content