**NJSC «Kazakh national research technical university named after K. Satbayev»**

**Mining and metallurgical Institute named after |O.A. Baykonurov**

**Department of "Mining"**

# EDUCATIONAL PROGRAMM "MINING ENGINEERING"

## Doctor of Philosophy PhD in Education Program "8D07203 - Mining Engineering"

1-st 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 named after K.I.Satbayev**

Director of the mining and metallurgical Institute named after O.A. Baykonurov — Rysbekov K.B.

Head of the Department Mining — Moldabayev C.K.

Chair of the TG of the department, Professor — Sandibekov M.N.

**From the employer:**
1. Member of the Board of Directors of Kazakhaltyn Mining and Metallurgical Concern JSC, expert of Kazakhmys Corporation LLP, doctor of technical sciences, Professor Bitimbaev M.Zh.;
2. Director of the Inctitute of Mining named after D.A. Kunaev, doctor of technical sciences, professor Buktukov N.S.;
3. Vice president of LSC "Altynalmas" Bachramov B.A.

Approved at the meeting of the Academic Council of Kazakh national research technical university named after K.I. Satbayev. Protocol № 3 of 25.06.2021

**Qualification:**
8D-level of education according to the National qualifications framework
08 Engineering, manufacturing and construction industries
072 Manufacturing and manufacturing industries (PhD)

**Academic degree:** doctor of philosophy (PhD) in the field of Manufacturing and processing industries.
Duration of training: 3 years

**Professional competence:** Providing deep theoretical knowledge and practical skills in the development of solid minerals; ability to make effective engineering decisions on the operation and reconstruction of mining enterprises, various objects on the surface and underground; professional skills in working with a computer as a control tool, with General-purpose software; knowledge of the main technological processes at mining enterprises of ferrous and non-ferrous metallurgy, heat and power complex, nuclear industry, metro construction, depending on the chosen field of training.

## Content

## 1 Normative references

Table 1 - a List of regulatory and other documents, links to which are present in the document

| № | Document's name | Storage |
|---|---|---|
| 1 | The Law of the Republic of Kazakhstan "On Education" with amendments and additions within the framework of legislative changes to increase the independence and autonomy of universities from 04.07.18, No. 171-VI. | Registrar Office (RO)<br><br>http://online.zakon.kz/Document/?doc_id=30118747 |
| 2 | State compulsory standard of higher education (Appendix 7 to the order of the Minister of Education and Science of the Republic of Kazakhstan dated 10.31.18, No. 604 | RO http://online.zakon.kz |
| 3 | European Higher Education Qualifications Framework | RO http://ecahe.eu/w/images/7/76/A_Framework_for_Qualifications_for_the_European_Higher_Education_Area.pdf |
| 4 | Dublin descriptors | http://ecahe.eu/w/index.php/Dublin_Descriptors |
| 5 | GOST 3.1105-2011 Unified system of technological documentation (ESTD). Forms and rules for processing general-purpose documents | http://online.zakon.kz/document/?doc_id=31194118 |
| 6 | Regulations Satbayev University | Department of Internal Audit |
| 7 | National qualifications framework. Astana, 2016 | https://atameken.kz/uploads/content/files/Национальная рамка квалификаций_2016.pdf |
| 8 | Professional standard | https://atameken.kz/uploads/content/files/.pdf |
| 9 | Образовательная программа «Горная инженерия» | https://official.satbayev.university/download/document/17466/Горная инженерия ру 2018.pdf |

## 2 Abbreviations used. Terms and Definitions

Table 2 - Abbreviations Used

| Abbreviation | Full name |
|---|---|
| ECTS | European credit transfer and accumulation system |
| SU | Satbayev university |
| ME&SRK | Ministry of Education and Science of the Republic of Kazakhstan |
| PPS | Professorsko-prepodavatel'skiy sostav |
| EP | Educational program |
| RO | Registrar Office |
| SP | OP curriculum |
| RUP | Working curriculum OP |

Table 3-Terms and definitions used in the document text

| Term | Definition |
|---|---|
| Bachelor's degree | The level of higher professional education with the award of the academic degree "bachelor» |
| Bachelor | Academic degree awarded to individuals who have completed a bachelor's degree progra |
| Dublin descriptors | Part of the European framework of higher education qualifications describing the degree of competence development |
| Competency | The ability of students to apply the knowledge, skills and abilities acquired in the course of training in professional activities |
| Audit | Qualitative characteristics of the student assessment system |
| Credit Education | Training based on students ' choice and independent planning of the sequence of studying disciplines using credit as a unified unit of measurement of the amount of academic work of the student and teacher |
| Matrix of Competencies | Based on the Dublin descriptors describing the depth of development of competencies within the framework of the OP |
| Modular training | Segment of development and depth of student development of competencies that have an intermediate completed cycle |
| Educational program or OP | Description of the educational process based on achievements learning outcomes and competencies for obtaining a recognized diploma in a particular field of professional activity |
| Students | Individuals enrolled in the undergraduate program |
| Evaluation (Assessment) | Quantitative characteristics of the student assessment system |
| Applied baccalaureate General engineering | Completion of the minimum baccalaureate framework with at least 124 credits of theoretical training |
| The curriculum | A document containing a complete list of compulsory and elective academic subjects, indicating the number of credits, the sequence of subjects studied, types of training sessions, and forms of control |
| Framework of Competencies | Based on the Dublin descriptors describing the depth of competence development |
| Learning outcomes | Knowledge, skills, qualifications, competence |
| Sub-competency | The ability of students to apply the knowledge, skills and abilities acquired in the course of training within a certain competence |
| Final year student or graduate | Persons from the number of students who have successfully completed a full theoretical course of study |

## 3 Brief description of the program:

### 3.1 the purpose of the educational program:

- creation of an effective system of training of scientific, scientific and pedagogical personnel of a new formation on the basis of integration of education and science, capable of solving issues of improving society, economy, production, science and development of new technologies;

- harmonization of domestic technologies for training highly qualified scientific

and pedagogical personnel with international standards, as well as advanced solution of issues related to their scientific, methodological, legal, financial, economic, personnel and material support;

- implementation of the educational process in accordance with the principles of international practice of training highly qualified scientific and pedagogical personnel who are competitive in the modern labor market.

**3.2 Types of employment are:**

- in the field of research activities;
- in the field of design and technical activities;
- in the field of organizational and managerial activities;
- in the field of production and technological activities;
- in the field of project activities;
- in the field of innovation
- in the field of program and management activities.

**3.3 The Objects of professional activity are mining** enterprises of ferrous and non-ferrous metallurgy, fuel and energy complex, production of non-metallic mining raw materials, industrial research and design institutes, laboratories of higher and secondary technical and primary professional educational institutions.

According to The approved Protocol of the Meeting of the industry commissions on social partnership and regulation of social and labor relations for the mining and metallurgical, chemical, construction and wood-processing, light industry and mechanical engineering dated August 16, 2016 No. 1, doctor of philosophy (PhD) work experience corresponds to the following levels of the industry qualifications framework (ORC): level 8 – President of the enterprise, General Director.

## 4 Scope and content of the program

The educational program of the doctor of philosophy (PhD) has a scientific and pedagogical orientation 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.

Educational program of preparation of professional doctorate involves fundamental educational, methodological and research preparation and in-depth study of disciplines in relevant areas of science for branches of national economy, social sphere: education, medicine, law, art, Economics, business administration and national security and military Affairs.

Educational programs of doctoral studies in the field of professional training are

developed on the basis of studying the experience of foreign universities and research centers that implement accredited programs for training PhD doctors or doctors in the profile.

The content of the educational program of specialized doctoral studies is set by the University independently.

The main criterion for completion of the educational process for the preparation of doctors of philosophy (PhD) (doctor in profile) is the development of a doctoral student at least 185 academic credits, including all types of educational and scientific activities.

The duration of doctoral studies is determined by the amount of academic credits earned. When you complete the set amount of academic credits and achieve the expected learning outcomes for the degree of doctor of philosophy (PhD) or profile, the educational program of the doctoral program is considered fully completed.

Training in doctoral studies is carried out on the basis of educational programs of doctoral studies in two areas:

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

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

The content of the OP "Mining engineering" based on the development of a multi-level system of personnel training, the fundamental nature and quality of training, continuity and continuity of education and science, unity of training, education, research and innovation activities aimed at maximum satisfaction of consumer needs should provide:

- provision of high-quality professional education in the field of development of mineral deposits (MPI) confirmed the level of knowledge, skills and competencies based on established State educational standard of the criteria of evaluation in content and volume:
- training of professional and competitive specialists in the field of MPI development and creation of new mining technologies and production management;
- ability to apply knowledge of mathematics, fundamental and technical Sciences;
- use of methods for analyzing and evaluating the results of experiments.

The educational program of the specialty "Mining engineering" contains the full list of academic disciplines, grouped in cycles base (DB) and majors (PD) as mandatory components, and components for selection, indicating the complexity of each subject in the credits established by the State compulsory standards of higher and postgraduate education approved in accordance with Law of RK dated 04.07.2018, No. 171-VI SAM, see order of the Minister of education and science of the Republic of Kazakhstan from October 31, 2018 No. 604.

Objectives of the educational program:

- training of PhD doctors who are competitive both within the country and in the international labor market, integration of national doctoral programs into the world educational space;
- monitor, analyze and evaluate the actions of subordinates, manage the team of performers, including in emergency situations;
- carry out work to improve production activities, develop projects and programs for the development of the enterprise (divisions of the enterprise);
- analyze the processes of mining, mining and construction industries and complexes of equipment used as management objects;
- plan and perform theoretical, experimental and laboratory research, process the results obtained using modern information technologies;
- carry out a patent search, to study scientific and technical information, domestic and foreign experience on the subject of research;
- develop models of processes and phenomena, evaluate the reliability of the constructed models using modern methods and information analysis tools;
- carry out technical and economic assessment of solid mineral deposits and underground construction facilities, the efficiency of using technological equipment;
- justify the parameters of the mining enterprise;
- perform calculations of technological processes, productivity of technical means of complex mechanization of works, throughput of transport systems of mining enterprises, make schedules of work organization and calendar plans for production development;
- substantiate design decisions to ensure industrial and environmental safety, economic efficiency of production facilities for operational exploration, mining and processing of minerals, during the construction and operation of underground facilities;
- develop the necessary technical documentation as part of creative teams and independently;
- independently draw up projects and passports for mining and drilling and blasting operations;
- design enterprises for the extraction and processing of solid minerals, as well as the construction of underground facilities using modern information technologies.

## 5 Requirements for applicants

Persons who have a master's degree and at least 1 (one) year of work experience or have completed residency training are accepted for doctoral studies.

Admission to the number of doctoral students is carried out by the admissions committees of Universities and research organizations based on the results of the entrance exam for groups of educational programs of doctoral studies and a

certificate confirming foreign language proficiency in accordance with the common European competencies (standards) of foreign language proficiency.

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

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

The procedure for admission of 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 a 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 free postgraduate education on a competitive basis in accordance with the state educational order, if they receive this level of education for the first time.

At the" entrance", the doctoral student must have all the prerequisites necessary for the development of the corresponding professional training program of the doctoral program. The list of necessary 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.

## 6 Requirements for completion of training and obtaining a diploma

Persons who mastered the educational program of doctoral studies and defended his doctoral thesis at the positive decision of the dissertation councils of the UNIVERSITY with a special status or of the Committee for control in education and science, Ministry of education and science of the Republic of Kazakhstan on the results of the examination are awarded the degree of doctor of philosophy (PhD) or professional doctorate, and the diploma of the state sample with the Appendix (transcript).

Individuals who have received a PhD degree, in order to deepen their scientific knowledge, solve scientific and applied problems on a specialized topic, perform a postdoctoral program or conduct research under the guidance of a leading scientist chosen by the University.

### 6.1 requirements for key competencies of doctoral graduates:

1) have an idea of:

- the main stages of development and change of paradigms in the evolution of science;

- about the subject, ideological and methodological specifics of natural (social, humanitarian, economic) Sciences;
- about scientific schools of the relevant branch of knowledge, their theoretical and practical developments;
- about scientific concepts of world and Kazakhstan science in the relevant field;
- on the mechanism of implementation of scientific developments in practice;
- on the norms of interaction in the scientific community;
- on the pedagogical and scientific ethics of a research scientist;

2) know and understand:

- current trends, trends and patterns of development of Russian science in the context of globalization and internationalization;
- methodology of scientific knowledge;
- achievements of world and Kazakhstan science in the relevant field;
- (realize 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 research process;
- analyze, evaluate and compare various theoretical concepts in the field of research and draw conclusions;
- analyze and process information from various sources;
- conduct 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;
- choose and effectively use modern research methodology;
- plan and forecast your future professional development;

4) have the skills:

- critical analysis, evaluation and comparison of various scientific theories and ideas;
- analytical and experimental research activities;
- planning and forecasting of research results;
- public speaking and public speaking at international scientific forums, conferences and seminars;
- scientific writing and scientific communication;
– planning, coordination and implementation of the processes of scientific research;
- 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 management;
- responsible and creative attitude to scientific and educational activities;
- conducting patent search and experience in transmitting 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) to be competent:

– in the field of scientific and scientific-pedagogical activity in the conditions of rapid updating and growth of information flows;
- in conducting theoretical and experimental scientific research;
– in the formulation and solution of theoretical and applied problems in scientific research;
- to conduct a professional and comprehensive analysis of problems in the relevant field;
- interpersonal communication and human resource management;
– in matters of University training of specialists;
- in carrying out expertise of scientific projects and research;
- to ensure continuous professional growth.

**6.2 Research Requirements for a student of the doctor of philosophy (PhD) program):**

1) compliance with the main issues of the educational program of the doctoral program, which is defended by the doctoral dissertation;

2) relevant and contains scientific novelty and practical significance;

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

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

5) is carried out using modern methods of scientific research;

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

**6.3 Requirements for the organization of practices:**

The practice is conducted for the purpose of developing practical skills in scientific, scientific-pedagogical and professional activities.

The educational program of the doctoral program includes:

1) teaching and research practice - for students of the doctor of philosophy program;

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

During the period of teaching practice, doctoral students, if necessary, are involved in conducting classes in bachelor's and master's degrees.

The research practice of a doctoral student is conducted in order to study the latest theoretical, methodological and technological achievements of domestic and foreign science, as well as to consolidate practical skills, apply modern research methods, process and interpret experimental data in a dissertation research.

Practical training of a doctoral student is carried out in order to consolidate the theoretical knowledge obtained in the course of training and improve the professional level.

The content of research and production practices is determined by the topic of the doctoral dissertation.

# 7 Working curriculum and modular educational program

**WORKING CURRICULUM**

**Educational program - 8D07203 "Mining Engineering"**

**enrolment for 2021 - 2022 academic year**

**Full-time** study **Term of study:** 3 years **Academic Degree:** Doctor of Philosophy (PhD)

| year of study | Code | Name of course | Component | Academic credits | total times | lecture/ laboratory/ practice | SIS (including STIS), in hours | Prerequisites | Code | Name of course | Component | Academic credits | total times | lecture/ laboratory/ practice | SIS (including STIS), in hours | Prerequisites |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **1 semester** | | | | | | | | **2 semester** | | | | | | | |
| | 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 | 0/0/3 | 105 | | AAP350 | Pedagogical practice | BD | 10 | | | | |
| | MIN314 | Innovative technologies for the extraction of uranium by in-situ leaching | PS OC | 5 | 150 | 2/0/1 | 105 | | | | | | | | | |
| | MIN318 | Management of the spatial position of the contours of deep quarries | | | | | | | | | | | | | | |
| | MIN311 | The development of the theory and design methods of drilling and blasting operations in the development of mineral deposits | | | | | | | | | | | | | | |
| | MIN313 | Geotechnical support for the development of underground space | PS OC | 5 | 150 | 2/0/1 | 105 | | | | | | | | | |
| | MIN315 | Scientific support of technical solutions for underground mining processes | | | | | | | | | | | | | | |
| | MIN316 | Automated design and production of mass explosions in open pits | | | | | | | | | | | | | | |
| | MIN317 | Physico-chemical geotechnology | PS OC | 5 | 150 | 2/0/1 | 105 | | | | | | | | | |
| | MIN320 | Designing the combined development of mineral deposits | | | | | | | | | | | | | | |
| | MIN319 | Scientific substantiation of the construction of special underground structures | | | | | | | | | | | | | | |
| | | **In total:** | | **25** | | | | | | **In total:** | | **34** | | | | |
| 2 | **3 semester** | | | | | | | | **4 semester** | | | | | | | |
| | 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** | | | | |
| 3 | **5 semester** | | | | | | | | **6 semester** | | | | | | | |
| | 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 named after K.I.Satpayev. Protocol No. ___ of "____" ____ 20**

**Decision of the Academic Board of the Institute Protocol No. ___ of "____" _____ 2021.**

**Vice-Rector for academic affairs** **B.A.Zhautikov**

**Director of the Institute of Geology, Oil and mining** **A.H.Syzdykov**

**Head of the Department "Mining"** **S.K.Moldabayev**

**Chairman of the Specialty Council from employers** **N.S. Buktukov**

| 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 principal subjects (PS IC, PS OC) | 20 |
| **All on the theoretical classes:** | 45 |
| DSRW | 123 |
| Writing and defending doctoral dissertation | 12 |
| **In all:** | **180** |

| The cycle | code | Name of disciplines | Semester | Acad. credits | lec. | lab. | prac | IWS | Type of control | Chair |
|---|---|---|---|---|---|---|---|---|---|---|
| **Profile training module (50 credits)** | | | | | | | | | | |
| **Basic disciplines (BD)** | | | | | | | | | | |
| **University component** | | | | | | | | | | |
| BD 1.2.1 | MET321 | Research methods | 1 | 6 | 2 | 0 | 1 | 3 | Exam | MPHESMT |
| BD 1.2.2 | LNG304 | Academic writing | 1 | 6 | 2 | 0 | 1 | 3 | Exam | EL |
| **Choice component** | | | | | | | | | | |
| BD 1.2.3 | MIN314 | Innovative technologies for the extraction of uranium by in-situ leaching | 1 | 6 | 2 | 0 | 1 | 3 | Exam | ME |
| BD 1.2.4 | MIN318 | Management of the spatial position of the contours of deep quarries | | | | | | | | |
| BD 1.2.5 | MIN311 | The development of the theory and design methods of drilling and blasting operations in the development of mineral deposits | | | | | | | | |
| **Practice-oriented module** | | | | | | | | | | |
| BD | AAP350 | Pedagogical practice | 2 | 10 | | | | | Report | ME |
| **Major disciplines (MD)** | | | | | | | | | | |
| **University component (UC)** | | | | | | | | | | |
| MD 1.3.1 | MIN320 | Designing the combined development of mineral deposits | 1 | 6 | 2 | 0 | 1 | 3 | Exam | ME |
| **Choice component** | | | | | | | | | | |
| MD 1.3.2 | MIN313 | Geotechnical support for the development of underground space | 1 | 6 | 2 | 0 | 1 | 3 | Exam | ME |
| MD 1.3.3 | MIN315 | Scientific support of technical solutions for underground mining processes | | | | | | | | |
| MD 1.3.4 | MIN316 | Automated design and production of mass explosions in open pits | | | | | | | | |
| **Practice-oriented module** | | | | | | | | | | |
| MD | AAP349 | Research scientific training | 3 | 10 | | | | | Report | ME |
| **Research Module** | | | | | | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| DSRW | AAP345 | Doctoral student research work, including internships and doctoral dissertations | 2 | 24 | | | | | Report | ME |
| DSRW | AAP345 | Doctoral student research work, including internships and doctoral dissertations | 3 | 24 | | | | | Report | ME |
| DSRW | AAP346 | Doctoral student research work, including internships and doctoral dissertations | 4 | 25 | | | | | Report | ME |
| DSRW | AAP346 | Doctoral student research work, including internships and doctoral dissertations | 5 | 25 | | | | | Report | ME |
| DSRW | AAP346 | Doctoral student research work, including internships and doctoral dissertations | 5 | 25 | | | | | Report | ME |
| **Final attestation module** | | | | | | | | | | |
| FA | ECA303 | Writing and defending doctoral dissertation | 6 | 12 | | | | | | |
| | | **Total** | | **185** | | | | | | |

## 8 Descriptors of level and volume of knowledge, abilities, skills and competencies

Descriptors third level, within an overarching framework of qualifications of the European higher education area (RK-EHEA) reflect the learning outcomes characterizing the ability of the student:

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

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

3) contribute their own original research to the expansion of 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) promote knowledge-based technological, social or cultural development in the academic and professional context.

**General human, social and ethical competences (GHSEC)**

G-1 Have an understanding of the pedagogical and scientific ethics of the scientist-researcher

G-2 Have an understanding of the norms of interaction in the scientific community

G-3 Ability to critically use the methods of modern science in practice

**Special and management competencies (SMC)**

S-1 To independently manage and control the processes of work and educational activities within the framework of the strategy, policy and goals of the organization, discuss problems, argue conclusions and competently operate with information

S-2 Organize the activities of the production team, make organizational and managerial decisions in the context of different opinions and assess the consequences of decisions made

S-3 Conduct independent scientific research, characterized by academic integrity, based on modern theories and methods of analysis

S-4 Willingness to lead and participate in the preparation of mining projects for a variety of purposes

**Professional competence (PC)**

PC-1 Analyze the state of a scientific and technical problem and determine the goals and objectives of designing robotic and mechatronic systems based on the study of world experience

PC-2 Own a modern assortment, composition, properties and scope of industrial explosive materials, equipment and blasting devices approved for use in the

Republic of Kazakhstan, the main physical, technical and technological properties of mineral raw materials and host rocks, characteristics of the state of rock masses, construction and reconstruction facilities;

PC-3 Skills in conducting scientific research, performing laboratory and experimental research with subsequent processing of the results using modern computer technologies, improving existing and developing new research methods and techniques, technical and technological solutions and hardware for their implementation, the choice of technical means for carrying out research work ;

PC-4 The ability to choose the technology for the production of mineral processing works, to draw up the necessary documentation in accordance with the current regulations.

## 9 Appendix to the ECTS diploma

The app was developed by the European Commission, Council of Europe and UNESCO standards/Sepes. This document serves only for academic recognition and is not an official confirmation of the document of education. It is not valid without a higher education diploma. The purpose of completing the European application is to provide sufficient information about the diploma holder, the qualification they have received, the level of this qualification, the content of the training 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 for transferring ratings uses the European credit transfer and 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 traveling abroad for professional recognition, additional legalization of the diploma of education will be required.

The European diploma Supplement is completed in English upon individual request and is issued free of charge.

## Matrix of competencies of the educational program

| Discipline index | Name of disciplines | P1 | P2 | P3 | G1 | G2 | G3 | G4 | S1 | S2 | S3 | S4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LNG305 | Academic writing | | | | | X | | | | | | |
| MET322 | Research methods | | | | | X | X | X | | | X | |
| MIN 311 | Development of the theory and methods of designing drilling and blasting operations in the development of mineral deposits | X | | | X | | | | X | | X | |
| MIN 314 | Innovative technologies for uranium mining by underground borehole leaching | | X | X | | | | | | | | X |
| MIN 315 | Scientific support of technical solutions for underground mining processes | | X | | | | | | | X | | |
| MIN 316 | Computer aided design and production of massive explosions from quarries | | X | X | | | | | | | | X |
| MIN 317 | Physical and chemical geotechnology | | | | | | | | | | | |
| MIN 318 | Controlling the spatial position of the contours of deep quarries | | X | | | | | | | X | | |
| MIN 319 | Scientific substantiation of the construction of special underground structures | X | X | | | | X | | | | X | |
| MIN 320 | Design of combined development of mineral deposits | X | | X | | X | | | | | | |
| ECA303 | Writing and defending a doctoral dissertation | X | X | X | X | X | X | X | X | X | X | X |
| | | | | | | | | | | | | |

## 10 Brief descriptions of the disciplines

**Scientific research methods**
CODE – MET322
КРЕДИТ – 5 (2/0/1)

PURPOSE AND TASKS OF THE COURSE

The purpose of the discipline is to develop doctoral students' skills and abilities in the field of methodology of scientific knowledge. The objectives of studying this discipline are: - Mastering the methodological foundations of scientific knowledge and creativity; - Gaining knowledge in the field of similarity and modeling of physical processes, computational experiment; - mastering the technique of setting up an optimal experiment and processing measurement results.

BRIEF DESCRIPTION OF THE COURSE

The concept of methodology as a system of principles and methods of organization, construction of theoretical and practical activities. The concept of "activity". Structural components of activity. Scientific foundations of the methodology of science. Scientific knowledge and scientific research. Science as a social institution. General laws of the development of science. The structure of scientific knowledge. Scientific profiles and their relationship with extra-scientific professional (including teaching) activities. Opportunities for changing the scientific profile of a professional activities. Criteria for the scientific character of knowledge. Classification of scientific knowledge. Theoretical and empirical research, their relationship. Fundamental and applied research. Forms of organization of scientific knowledge.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

doctoral student should know:

- features of the choice of 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;

A doctoral student must be able to:

- to analyze the trends of modern science, to determine the promising directions of scientific research in the subject area of professional activity, the composition of research papers, which determine their factors;
- to 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.

must own:

- modern methods of scientific research in the subject area;
- ways of comprehending and critical analysis of scientific information; - skills to improve and develop their scientific potential.

**Academic writing**

CODE – LNG305

CREDIT – 5 (2/0/1)

PURPOSE AND TASKS OF THE COURSE

The aim of the course "Academic writing" is the formation of professional competence and the expansion of communicative competence associated with analytical textual activity; the formation of students' skills of linguistic and pragmatic thinking, the ability to analyze expressive units of the language and competently select the desired unit, depending on the goals and conditions of communication. The aim of the course is to improve the ability to write scientific articles for subsequent publication in international scientific journals.

The objective of the course is to acquaint with the peculiarities of academic genres (annotations, abstract, analytical review, as well as messages about a scientific event (conference)); define the main goals of analytical word processing; teach to analyze texts on professional topics.

BRIEF DESCRIPTION OF THE COURSE

The Academic Writing course teaches effective academic writing using practical examples and exercises. Academic writing skills are required for academic staff and university students for publications in foreign scientific journals, participation in international scientific conferences, master's or doctoral studies at a foreign university within the framework of academic mobility programs.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

The doctoral student should know:

- the goals and objectives of analytical processing of texts in the modern information space;
- genre and stylistic characteristics of annotation, abstract, analytical review, scientific communication;
- the principles of the communicative organization of annotation and abstract; - rules for writing reviews; be able to:
- conduct a stylistic analysis of scientific, scientific and technical and popular science texts,
- to determine the stylistic and genre affiliation of the text in the sphere of professional information;
- highlight the style-forming elements of texts,
- carry out a semantic analysis of the text and highlight its keywords;
- determine the means of speech expression;

- transfer the content of texts in the form of annotations, abstracts, reviews; own:

- methods of semantic analysis of the text;

- the method of communicative analysis of the text; - genres of annotation and abstract.

**Development of the theory and methods of design of drilling and blasting operations in the development of mineral deposits**

CODES-MIN 311
CREDIT – 5 (2/0/1)
PREREQUISITES

COURSE GOALS AND OBJECTIVES

The purpose of the course is to train highly qualified specialists in the field of mining and metallurgical production. The purpose of the course is to study innovative methods of conducting drilling and blasting operations in the extraction of minerals.

BRIEF DESCRIPTION OF THE COURSE

Modern technology of drilling operations. The range of industrial explosives used in Kazakhstan and abroad. Study of factors affecting the quality of explosives (industrial AND manufactured at mining enterprises). Chemistry of explosives; Physical bases of deformation and destruction of solids; Physical modeling of fast-flowing processes; Modern methods of initiating industrial EXPLOSIVES. Technologies of blasting operations in open-pit mining; Design and manufacture of drilling and blasting in the mining of useful iskopaemykh underground method; Shooting-blasting in the oil and gas industry; Synergy mining processes of drilling and blasting. Resource-saving technologies for drilling and blasting operations. Modeling and design of explosive technologies on a computer. Environmental aspects of drilling and blasting operations.

KNOWLEDGE AND SKILLS AT THE END OF THE COURSE

The process of studying the discipline is aimed at developing the following competencies:

- as a result of mastering the course, doctoral students have knowledge in the field of mining and blasting, development and implementation of measures to ensure industrial and environmental safety of mining, development and quality control of drilling and blasting projects, development, approval and approval of documents regulating the procedure for performing mining and blasting operations;

Ability to control the quality of blasting operations and ensure that they are performed correctly by performers; draw up drilling and blasting projects, work schedules and long-term plans, instructions, estimates, requests for materials and equipment, fill out the necessary accounting documents in accordance with the

established forms.

**The doctoral student should know:** modern technologies of drilling operations, the range of industrial explosives, innovative methods of conducting drilling and blasting operations in the extraction of minerals.

**The doctoral student should be able to:** choose rational methods of conducting drilling and blasting operations in specific mining and geological conditions, apply optimization of development parameters and completeness of extraction of minerals from the subsurface, draw up technical documentation for conducting drilling and blasting operations.

**The doctoral student must know:** the method of strategic planning for the development of blasting operations at mining enterprises using modern software products.

**Methodology of scientific research in open Geotechnology**

CODE-MIN 312

CREDIT – (2/0/1)

PREREQUISITE

COURSE GOALS AND OBJECTIVES

Training of specialists for planning research work, including theoretical, experimental and industrial methods of achieving knowledge.

The objective of the discipline is to study the subject, content and structure of mining science; the specifics of research in mining; methodological foundations for evaluating research results and methods for performing theoretical and experimental research.

BRIEF DESCRIPTION OF THE COURSE

Fundamentals of mining science and mining. Classification of science and their interaction. History of mining and mining science. Subject and content of mining science and its structure. Post-industrial future and mining science. Methods for achieving knowledge. Classification of research. The specificity of the research in mining. Experiment. Experimental and industrial work. Methodological foundations of economic assessment.

KNOWLEDGE, SKILLS AT THE END OF THE COURSE

After completing the course, the doctoral student will master the methods of achieving theoretical knowledge; methods of conducting experiments and experimental-industrial work; skills of preparing a research plan and forming scientific statements submitted for defense.

**The doctoral student should know:** the subject, content and structure of mining science, methods for achieving new knowledge, the theoretical basis for planning and conducting theoretical and experimental research.

**A doctoral student should be able to:** draw up a research plan based on theoretical knowledge, justify the number of necessary experiments, make an expert assessment of the effectiveness of the results obtained, formulate the goal, objectives, scientific novelty and scientific provisions of scientific research, and predict the desired result.

**Geotechnical support of underground space development**
CODE – 313 MIN
CREDIT – (2/0/1)
PREREQUISITE –

PURPOSE AND PURPOSE OF THE COURSE

The purpose of the discipline is to study the scientific and practical foundations of integrated and effective development of underground space based on the analysis and evaluation of fundamental technical solutions from the point of view of their innovation. The main task of studying the discipline is to master the methods of designing the construction of underground structures for various purposes and their calculation with a wide use of software products, in relation to specific operating conditions.

BRIEF DESCRIPTION OF THE COURSE

Problems, directions and ways to solve the problems of developing the underground space of megacities. World experience in integrated use of underground space. Modern methods of construction of vertical shafts. Requirements for the safety of the developed space of mines and mines. Mining companies. Underground industrial enterprises. Underground utilities. Underground transport structures. Underground environmental objects. Systematization of underground structures by main features. Modern methods of construction of large cross-section workings. Technology and construction of underground metro facilities. Technology and organization of construction of distillation tunnels using mining boards. Technological schemes for the construction of metro stations. Construction of underground structures in an open way. Technology of construction of underground passages using push-through installations and micro-panels. Technology of construction of collector tunnels technology of construction of transport interchanges, technology of construction of underground garages and other large-section workings.

KNOWLEDGE, SKILLS AT THE END OF THE COURSE

Student's competencies formed as a result of mastering the discipline:

- use of normative legal and instructional documents in their activities; Awareness of the social significance of their future profession, the presence of high motivation to perform professional activities;

- readiness to make a technical and economic assessment of construction conditions, investments; to choose space-planning solutions and basic parameters of engineering structures of underground facilities, to calculate their strength, stability and deformability; to choose materials for engineering structures of underground and mining buildings, and structures on the surface;

- ability to develop technological schemes and construction schedule, choose methods, equipment and technology of mining and construction works, focusing on innovative developments.

As a result of mastering the discipline, the student must:

**The doctoral student should know:** the characteristics of the exploitation of mineral resources and key technologies of construction of underground structures for various purposes; problems of complex development of mineral resources; the functions of the geological environment; scientific and engineering basis of the choice of technologies for mining and construction works and labour protection during the construction of underground structures; legal framework for the activities of mining manufactures and objects; design features at the complex system of preparation of project documentation of objects of the mining and use of underground space; requirements for the safety of the developed space of mines and mines.

**The doctoral student should be able to:** draw up and execute scientific, technical and service documentation; assess risks and determine measures to ensure the safety of technological processes in mining; apply the principles of rational use of natural resources and environmental protection in practice; organize the work of production units in the field of underground construction; draw up standard design, technological and working documents to ensure the rational use of underground space.

**Innovative technologies for mining uranium by underground well leaching**

CODE – 314 MIN

CREDIT – (2/0/1)

PREREQUISITE

COURSE GOALS AND OBJECTIVES

The purpose of the course is to train specialists for production and research activities in the field of uranium mining by underground well leaching.

The aim of the course is to study modern, innovative technologies of underground borehole leaching of uranium.

BRIEF DESCRIPTION OF THE COURSE

Characteristics of minerals suitable for mining uranium by underground borehole leaching, problems with underground borehole leaching of uranium, geotechnological processes, modern methods of activating working solutions, innovative ways to eliminate colmatation and increase the inter-repair cycle of

geotechnological wells, composition of solutions, equipment of the geotechnological field, reagents used in geotechnological methods of development, protection of the subsurface.

KNOWLEDGE, SKILLS AT THE END OF THE COURSE

Get the skills and abilities to open, extract and process uranium using geotechnological methods.

**Scientific support of technical solutions in underground mining processes**

CODE – 315 MIN

CREDIT – (2/0/1)

PREREQUISITE-

GOALS AND OBJECTIVES

The purpose of the course is to train specialists to scientifically substantiate new technical solutions in underground mining processes

The purpose of the course is to provide scientific support for new methods, methods, and technologies for underground mining.

BRIEF DESCRIPTION OF THE COURSE

Problems, prospects of development of the mining industry and scientific support of new technological solutions in the processes of underground mining of ore and non-metallic minerals

KNOWLEDGE, SKILLS AT the end of the COURSE

As a result of mastering the course, doctoral students should know the ways of scientific support of new methods, methods, and technologies for underground mining. Get the skills and knowledge of scientific support of new methods, methods, and technologies for underground mining.

**Computer-aided design and production of mass explosions at quarries**

CODE-MIN 316

CREDIT – 5 (2/0/1)

PREREQUISITE –

COURSE GOALS AND OBJECTIVES

The GOAL is to teach doctoral students to improve the efficiency of blasting operations in quarries by upgrading their technologies using innovative methods for determining the location of explosive charges (EXPLOSIVES)in the rock mass.

The task of the discipline is to study innovative methods for determining the parameters of the location of EXPLOSIVE charges in a rock mass at a given well diameter. Establishing dependencies of the resistance line along the bottom of the ledge, the distance between wells, the length of the charge above the level of the

ledge sole, the length of the uncharged part of the well, the length of the drill, the length of the charge in the well.

BRIEF DESCRIPTION OF THE COURSE

Composition and content of project documentation for blasting operations. The trend of development of explosive technologies with the deepening of mining operations. Characteristics of rock mass explosivity. Limit radius of the cavity during the explosion of a cylindrical EXPLOSIVE charge. Analytical determination of the geometric dimensions of the camber. Models of the collapse of rocks on the ledges in various technologies of explosive works. Designing parameters for the location of charges in the array. Designing the results of a mass explosion.

KNOWLEDGE, SKILLS AT THE END OF THE COURSE

After completing the course, the doctoral student will master methods for achieving theoretical knowledge; innovative methods for determining the parameters of the location of EXPLOSIVE charges in the rock mass at a given well diameter.

**The doctoral student should know:** creating a scientific basis for choosing effective blasting technologies that provide the required lumpiness of blasted rocks, their compact placement in the collapse, which increases the productivity of excavation and loading and transport equipment and ensures the competitiveness of quarry products.

**The doctoral student should be able to:** Determine the maximum relative radius of the explosive cavity in rocks; Perform appropriate calculations to determine the maximum relative radius of the cavity. Determine the parameters of the location of EXPLOSIVE charges in the rock mass for a given well diameter. To substantiate the principles of innovative methods for determining the parameters of the location of EXPLOSIVE charges in the rock mass. Determine the granulometric composition of the blasted rock mass during single-row blasting.

**Physical and chemical Geotechnology**

CODE – 317 MIN

CREDIT – 5 (2/0/1)

PREREQUISITES - COURSE

GOALS AND OBJECTIVES

The purpose and task of studying the discipline is the development of doctoral students ' knowledge on the basics of physics and chemical geotechnologies used in the complex use of underground space for the placement of objects of various functional purposes and the development of solid minerals. Instilling the skills of engineering calculations necessary for choosing the conditions, means and method of development of a solid mineral Deposit, as well as the construction of other mining structures using physical and chemical methods of Geotechnology in close connection with environmental protection.

BRIEF DESCRIPTION OF THE COURSE

The role of physical and chemical Geotechnology in the integrated use of underground space for placing objects of various functional purposes. Physical and chemical Geotechnology as a science. Definition of FHG as a science that studies the conditions, means and methods of developing solid minerals, as well as creating voids for their further use for the construction of underground structures. Current state of FHG. Stages of formation of physico-chemical methods of investigation (FHMG) and the current state FKHG. Objects of industrial development. Physical and chemical methods of Geotechnology and their classification. The essence of FHG methods. Physical, chemical and combined methods of FCH. Basic concepts and definitions. The main directions of FHG development. Cardinal tasks of the FHG. Establishment of optimal operation algorithms, management of processes and their complexes. The environment of the mountains, rocks, minerals and their properties. State of the mountain range. Hydraulic properties of the massif mining production. Physical and geological factors that determine the effectiveness of the mine FHMG. Chemical and mineralogical composition of deposits and host rocks. Mechanical properties of the Deposit and host rocks. Chemical composition, density and viscosity of underground water, etc. Requirements of FHG methods for the physical and geological environment. Requirements for the mining and geological conditions of the massif. Geological-hydrogeological work for the company, working FHMG. The main purpose of geological and hydrogeological services. Techniques geological service FHMG. Preparation of hydrogeological documents. Conditions for the construction of underground reservoirs in rock salt. Basic concepts and definitions. Space-planning conditions for placing underground reservoirs. Basic space-planning schemes for placing tanks. Defining the parameters of workings. Geological conditions for creating underground storage facilities in rock salt. Promising areas for the construction of underground reservoirs for the storage of gaseous and liquid products, and the disposal of industrial waste. Technology of construction of underground reservoirs. Theory and practice of creating underground workings-tanks in rock salt. The construction of the underground storage with the use of camouflet explosions. The essence of the method. Requirements for engineering and geological conditions. Drilling and blasting operations. Stability and fixing of underground workings-tanks for concrete splashes. Economic and social aspects of FHG methods. Protection of the earth's surface, air and water resources. Social significance of geotechnological methods.

KNOWLEDGE, SKILL, AND SKILLS AT THE END OF THE COURSE

**The process of studying the discipline is aimed at developing the following competencies:**

- the concept of FHG as a science that studies the conditions, means and methods of developing solid minerals, as well as creating voids for their further use for the construction of underground structures;

- readiness to use physical, chemical and combined methods of Geotechnology (fhmg) in the development of mineral deposits and construction of underground structures for various functional purposes.

**As a result of studying the discipline, the doctoral student should know:**

- history of creation of underground and buried objects for various purposes by methods of physical and chemical Geotechnology; design features and experience in the production of works; space-planning solutions and structures of objects for various purposes under construction by the FHG method; environmental problems of integrated use of FHG.

**The doctoral student should be able to:** navigate the main directions of integrated development of underground space by the FHG method.

**Managing the spatial position of deep pit contours**

CODE-MIN 318

CREDIT – 5 (2/0/1)

PREREQUISITE –

COURSE GOALS AND OBJECTIVES

Training of specialists for research and design work in the field of open-pit mining of ore and coal deposits.

The objective of the discipline is to study methods for managing the optimization of the spatial position of deep pit contours in order to select the most optimal and safe parameters of current Board structures that ensure stable extraction of minerals of the required quality with high-performance use of mining equipment and minimal costs.

BRIEF DESCRIPTION OF THE COURSE

Management of the spatial position of the contours of deep pits as a further development of a promising major scientific direction - management of the development of mining operations. The management of mining development has been enriched with ideas about the procedure for developing deposits in areas with different intensity, with a combination of different methods of development, equipment and technologies, as well as with the purposeful formation and use of the developed quarry space as a man-made resource. All this requires the development of methods for evaluating and optimizing the order of field development. In the far abroad, the algorithm for optimizing the current spatial position of the pit contours was tested with maximizing the NetPresentValue indicator for mining projects (in comparison with traditional mining planning, the proposed dynamic optimization method will reduce the dependence of the NetPresentValue indicator on the overburden coefficient due to multi-stage stabilization of the excavation rate).

Kazakhstan has developed a technology for high-rhythm mining operations on steep sides with safe high-performance use of excavator-automobile complexes).

KNOWLEDGE, SKILLS AT THE END OF THE COURSE

After completing the course, the doctoral student will master the knowledge to establish safe optimal parameters of the quarry and indicators of development of the mining transport system.

**The doctoral student should know:** methods for optimizing design solutions for periods and stages of open development of mineral deposits for the subsequent implementation of highly rhythmic mining operations.

**The doctoral student should be able to:** define pitwall stability, and substantiate the main parameters of the quarry, to establish the optimal direction uglubki and determine its speed at different number of used excavators, to perform mining-geometrical analysis of career fields and transforming it results in the optimal schedule of mining operations, to prepare financial and economic model of the quarry and to assess the required investments.

**Scientific justification for the construction of special underground structures**

CODE-MIN 319

CREDIT – 5 (2/0/1)

PREREQUISITE –

COURSE GOALS AND OBJECTIVES

The purpose of studying the discipline is to train highly qualified graduates who are able to organize the work of a team of performers, plan the design and construction of special underground structures in complex mining, geological and hydrogeological conditions, make independent technical decisions; conduct geotechnical surveys and scientific research for the design of buildings and underground structures, drawing up their plans; organize the process of construction of underground structures and structures using special technologies and modern equipment; conduct a feasibility study for the construction of underground structures and structures.

The main objectives of the discipline are: - study of special methods of construction of underground structures in complex mining and geological conditions; - mastering the methods, methods of production and organization of mining operations in complex mining and geological conditions; formation of skills of practical management of the process of construction of underground structures by special methods.

BRIEF DESCRIPTION OF THE COURSE

Generalities. Classification of special methods. Plugging of watered rocks in underground construction. General requirements for grouting solutions.

Strengthening of soils and rocks physical-chemical methods: cementation, bituminaria, silicification, solitary etc.Equipment for preparation and injection of grouting solutions. Design of grouting works. Organization of grouting operations when sinking a mine shaft. Construction of underground structures under compressed air. Construction of mine workings using water reduction. Construction of underground structures using the "Wall in the ground" method. Special methods for sinking the mouths of trunks in unstable rocks. Construction of mines with use of the freezing rocks. Calculations of stability and strength of ice-ground fences. Brine network and hydraulic calculations of the brine network. Scientific and technical basis of the method of freezing rocks. Sinking of horizontal and inclined mine workings by special methods.

KNOWLEDGE SKILLS AT THE END OF THE COURSE

As a result of mastering the discipline

**The doctoral student should know:** - ways of development and improvement of special methods of construction of underground structures; the essence of each method and the possibility of its application; technology and sequence of work in one or another special way for the construction of vertical, horizontal and inclined mine workings in various mining and geological conditions; regulatory documents and technical documentation that is used in production.

**The doctoral student must be able to:** - independently choose and justify the method of construction of underground structures using special methods, taking into account specific mining and geological and hydrogeological conditions; independently calculate the main parameters, select the necessary materials and equipment for performing work in this way; develop projects for the construction of underground structures in a special way; manage the implementation of a special method in production; improve the technology of performing these works; work with basic legal and regulatory documents; metrological rules, norms, normative and technical documents on standardization and quality management of construction; comply with environmental requirements during construction and improve labor safety conditions for employees.

**Design of combined development of mineral deposits**

CODE-MIN 320

CREDIT – 5 (2/0/1)

PREREQUISITE-

GOALS AND OBJECTIVES

The purpose of the course is to teach the future specialist the design features of combined development of mineral deposits

The goal of the course is to master the features of development and design in the combined development of mineral deposits

BRIEF description of the COURSE

Scientific basis for the design of opening and preparation, the main processes of clearing excavation in the combined development of ore deposits, software products for design.

KNOWLEDGE, SKILLS, SKILLS AT the end of the COURSE

As a result of mastering the course, doctoral students should master knowledge about the features of combining open and underground methods of field development in space and time, the design of opening and preparation, the main processes of treatment excavation in the combined development of ore deposits, software products for design, technical, economic, environmental and organizational relationships of technological processes in mining.

**Teaching practice**

CODE - AAP350

Credit-10

PURPOSE AND OBJECTIVES OF THE COURSE

The purpose of pedagogical practice: formation and development of professional skills of a doctoral student as a teacher of Higher education; mastering the basics of pedagogical skills, skills and abilities of independent conduct of educational work.

Doctoral students as future teachers of Higher education should be guided in the problems of organizing educational work, searching for new innovative approaches to teaching and educating students in the conditions of institutions of higher professional education in accordance with the trends and directions of development of modern education.

Tasks of pedagogical practice:

- to form a clear understanding of the planning of the content of the educational process of the Department;;
- improvement of analytical and professional activity of teachers;
- improve the skills of conducting training sessions with students;
- improve the skills of developing educational and methodological literature;
- to form an adequate self-assessment, responsibility for the results of their work.

BRIEF DESCRIPTION OF THE COURSE

Pedagogical practice of doctoral students is a practical training of future teachers, conducted in conditions as close as possible to the professional activity of a teacher. In the process of teaching practice, the professional and personal development of future teachers is activated. During the practice, doctoral students

make and implement a plan of educational activities with a group of students, develop and conduct a system of classes that reflect the completed segment of the educational process based on the content of specialized disciplines, demonstrate their knowledge of modern technologies and teaching methods.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE

To perform the program of pedagogical practice, the doctoral student must have knowledge in the field of pedagogy and technology of vocational training, psychology of adult education.

Pedagogical practice equips doctoral students with the necessary experience of professional and pedagogical activity and involves mastering the following professional and pedagogical skills:

- navigate the organizational structure and regulatory documentation of the vocational education institution;
- to be guided in the theoretical foundations of the science of the subject being studied;
- didactically transform the results of modern scientific research in order to use them in the educational process;
- independently design, implement, evaluate and adjust the educational process;;
- use modern innovations in the process of professional training;
- master the methods of self-organization of activity and improvement of the teacher's personality;
- build relationships with colleagues, find, make and implement management decisions in their scientific and pedagogical practice;
- master the conduct of various types of classes with students in a given academic discipline;
- master the culture of speech and communication.

**Research work of a doctoral student including passing an internship and completing a doctoral dissertation**

CODE - AAP345

CREDIT – 24

PURPOSE AND OBJECTIVES OF THE COURSE

The objectives of the research internship are:

- formation of professional and research competencies that contribute to the qualified conduct of scientific research within the chosen topic of the dissertation research;
- study of the latest theoretical, methodological and technological achievements of domestic and foreign science;

- consolidation of practical skills and application of modern methods of scientific research, analysis, processing and interpretation of experimental data in the dissertation research.

The main task of the research practice is the acquisition of doctoral students ' experience in conducting research and mastering such skills as:

- identification and formulation of current scientific problems;
- development of research and development programs, organization of their implementation;
- development of research methods and tools and analysis of their results;
- development of organizational and managerial models of processes, phenomena and objects, evaluation and interpretation of results;
- search, collection, processing, analysis and systematization of information on the research topic;
- practical participation in the research work of research teams;
- preparation of scientific reviews, reports, publications.

BRIEF DESCRIPTION OF THE COURSE

Research practice is a mandatory component of the doctoral program and is a type of practical activity related to the conduct of scientific research within the chosen topic of dissertation research, the preparation of scientific publications and the analytical part of the dissertation work.

Research practice of doctoral students is aimed at deepening and systematization of theoretical and methodological training of doctoral students, as well as at the formation and development of research competencies necessary for the analysis of modern scientific achievements, the use of research methods in solving practical scientific problems.

KNOWLEDGE, SKILLS AND ABILITIES AT THE END OF THE COURSE

To prepare for a scientific study, a doctoral student should study:

- methods of research and experimental work;
- rules of operation of research equipment;
- methods of analysis and processing of experimental data;
- physical and mathematical models of processes and phenomena related to the object under study;
- information technologies in scientific research, software products related to the professional sphere;
- requirements for the design of scientific and technical documentation;
- the procedure for implementing the results of scientific research and development.

At the same stage, the doctoral student develops a methodology for conducting the experiment.

Conducting an experimental study.

At this stage, the doctoral student assembles an experimental setup, installs the necessary equipment, develops a computer program, and conducts an experimental study.

Processing and analysis of the results obtained.

At this stage, the doctoral student conducts statistical processing of experimental data, draws conclusions about their reliability, analyzes them, and checks the adequacy of the mathematical model.

Innovative activity.

The doctoral student analyzes the possibility of implementing the research results, using them to develop a new or improved product or technology. Prepares an application for a patent, for participation in the competition of scientific works, an article for publication.

## 11 Defense of the doctoral dissertation

CODE-ECA 303

CREDIT -12

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

BRIEF DESCRIPTION

Doctoral thesis - scientific work of doctoral candidate, which is an independent study which developed the theoretical principles, the totality of which can be qualified as a new scientific breakthrough, or solved a scientific problem, or set forth scientifically grounded technological, economic or technological solutions, implementation of which makes a significant contribution to the economic development of the country.

Doctoral dissertation-the result of research experimental research work of a doctoral student, conducted during the entire period of study of the doctoral student.

The defense of a doctoral dissertation is the final stage of master's training. The master's thesis must meet the following requirements –

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