 <p>СӘТБАЕВ УНИВЕРСИТЕТІ</p>	<p align="center"><b>MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF KAZAKHSTAN</b></p> <p align="center"><b>NON-COMMERCIAL JOINT STOCK COMPANY KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY AFTER K. SATBAYEV</b></p>	
<p>SMQ Document 3 level</p>	<p align="center">Edition № 1 " 01 " 04 2022</p>	<p align="center">MS 029-03-05-02.1.01-2022</p>

**MODEL OF A GRADUATE (Bachelor)**  
**of educational program 6B07205 – Mining Engineering**

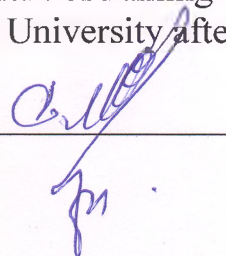
**MS 029-03-05-02.1.01-2022**

Almaty 2022

## PREFACE

**1 DEVELOPED** by Mining department of Mining-metallurgical institute of NJSC Kazakh National Research Technical University after K.I.Satpayev

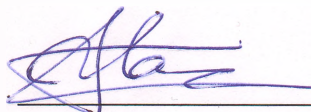
Chair of Mining department  
" 24 " 03 2022.



S. Moldabayev

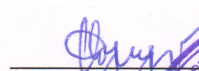
### 2 AGREED

Board member – Vice-rector  
for academic inquiries  
" 31 " 03 2022.



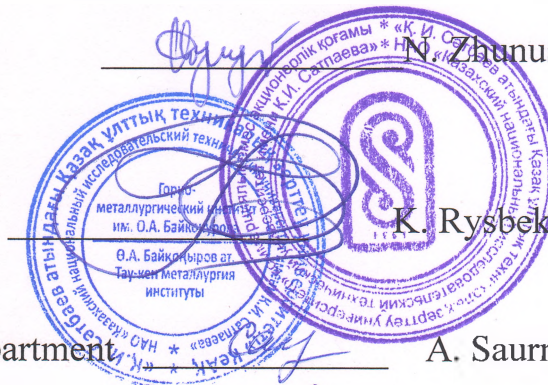
B. Zhautikov

Director of the Department  
of Academic Affairs  
" 30 " 03 2022.



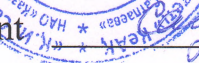
N. Zhunusbekova

Dean of Mining-metallurgical  
institute  
" 29 " 03 2022.



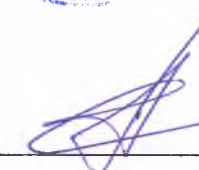
K. Rysbekov

Head of assessment and quality department  
" 28 " 03 2022.



A. Saurabayeva

A. head of Legal Support  
and Public Procurement department  
" 25 " 03 2022.



T. Abukenov

A.Head of documentation support and development  
of the national language department  
" " 2022.

Z. Orakbayeva

**3 DISCUSSED** and approved by Educational and methodological council of the Mining-metallurgical Institute (protocol №8 from 16 " 03 2022.)

**4 APPROVED** by the decision of the Board of NJSC KazNRTU after K.I. Satpayev from " 01 " 04 2022. № 5

### 5 Introduced for the first time

*Signature of a person responsible  
for the translation*

*Sarybayev N.M.*



## CONTENT

Introduction .....	4
1. Goals and objectives of the educational program 6B07205 – Mining engineering .....	6
2. List of qualifications and positions .....	6
3. Descriptors.....	7
4. General competencies.....	8
4.1 Social and humanitarian.....	8
4.2 Economic, organizational and managerial.....	9
4.3 General scientific .....	9
4.4 General technical.....	9
5. Professional competencies .....	10
5.1 Settlement and project activities .....	10
5.2 Production and technological activities .....	10
5.3 Experimental research activities .....	10
5.4 Organizational and managerial activities.....	10
5.5 Functions of professional activity .....	11
5.6 Typical tasks of professional activity .....	11
5.7 Direction of professional activity.....	11
5.8 Content of professional activity .....	11
5.9 Requirements for the Bachelor's key competencies in EP 6B07205-Mining Engineering .....	12
5.10 The main national goals of education and the hierarchy of goals .....	14
5.11 Requirements for the level of education of graduates .....	14
5.11.1 Requirements for general education .....	14
5.11.2 Requirements for social and ethical competence .....	15
5.11.3 Requirements for economic and organizational and managerial competencies.....	15
5.11.4 Requirements for professional competence .....	15
5.11.5 Requirements for readiness to change social, economic, professional roles, geographical and social mobility in conditions of increasing dynamism of changes and uncertainties.....	15
5.11.6 Requirements for education in the main cycles of academic disciplines .....	15
6. Expected results by years of study .....	16
Conclusion .....	17
Registration sheet for changes.....	18

## Introduction

The specialist's model should be systemic in nature, reflect the advantages of qualification and competence approaches.

In the competence model of a specialist, the goals of education are associated not only with the performance of specific functions, but also with integrated requirements for the outcome of the educational process. The competency-based approach covers, along with specific knowledge and skills, categories such as the ability and willingness to learn, social skills, etc.

Mining operations by open, underground methods, geo-technology for the development of uranium deposits (PSV of uranium), construction of mines and underground structures, surveying. Depending on the training trajectory, modern trends in the development of mining production in market conditions under various mining production modes are taken into account.

Modern conditions impose new requirements on graduates, among which the requirements of systemically organized, intellectual, communicative, self-organizing principles receive increasing priority.

The quality of professional training depends on the degree of substantiation of three main points:

- Goals and objectives of the educational program
- Training content
- Principles of the organization of the educational process

Taking into account the opinion of potential consumers and the association of graduates of KazNRTU named after K.I.Satpayev, in accordance with the mission of the University and the requirements of the State Mandatory Education Standard of the Republic of Kazakhstan, the goals and objectives of the educational program of the specialty 6B07205 - Mining Engineering were formulated and approved by the Academic Council of the Mining and Metallurgical Institute.

The content of the training should meet the requirements of the modern level of development of the Mining industry, mastered by the bachelor throughout the training.

The competence matrix is a tool for determining the minimum abilities of a bachelor of the educational program of specialization 6B07205 - Mining Engineering. The structure of the matrix allows you to assess the minimum competence necessary for the entire career growth. It is also used to approve future industrial standards and can be used by companies to evaluate their personnel.

The specialist model provides for:

- competencies conditioned by the development of modern science and technology;
- competencies dictated by the requirements of the profession, specialty;
- competencies determined by the socio-political system of the country, its spiritual and moral system.

The specialist model has historically been embodied in various forms: qualification characteristics and professionograms.

In order to acquire a complex of professional, intercultural, communicative competencies, a graduate must master the knowledge of a combination of general education (OOD), basic (DB) and profile (PD) disciplines, both their mandatory component and the component of choice in accordance with the chosen trajectory of education in full, established by the state standard.

Of great importance in the modern world is the ability to navigate the information flow: the ability to find and systematize various sources of information according to a certain criterion; to use rational ways of obtaining, transforming, systematizing and storing information, to update it in the necessary situations of intellectual and cognitive activity, as well as computer literacy, knowledge of new information and multimedia technologies (e-mail, Internet), the ability to critically evaluate information.



## 1 Goals and objectives of the educational program 6B07205 – Mining engineering

Purpose: To train professionally educated and competent specialists for mining enterprises who are able to work in primary engineering and technical positions and effectively extract natural resources in various mining, geological and mining technical conditions based on advanced technologies and modern mining equipment.

Tasks:

1. Implementation of a training program for specialists in engineering and technology who have the skills of designing, constructing and operating mining workings and have fundamental training in general educational, basic and specialized disciplines that provide the student with an opportunity for further self-improvement of the level of training.

2. Providing the learner with knowledge, skills, skills and competencies that allow them to see, analyze and find solutions to engineering problems in the field of professional activity using modern computer technologies and the results of experimental research.

3. Providing social and humanitarian education based on the laws of socio-economic development of society, history, the state language, Russian and other foreign languages, supporting the ideals of ethical behavior, professionalism and environmentally responsible use of natural resources.

## 2 List of qualifications and positions

A bachelor's degree graduate in OP 6B07205 - "Mining Engineering" is awarded an academic bachelor's degree.

Qualifications and positions are determined in accordance with the National Qualifications Framework (NQF) approved by the Protocol of March 16, 2016 by the Republican Tripartite Commission on Social Partnership and Regulation of Social and Labor Relations.

Graduates of the specialty 6B07205 - "Mining Engineering", regardless of the training trajectory, can work in the following positions:

- quality engineer;
- senior dispatcher;
- dispatcher;
- shift master;
- technologist;
- process engineer;
- surveyor.

Types of professional activity

Bachelors of OP 6B07205 - "Mining Engineering" can perform the following types of professional activity:

- Experimental research;
- Production and technological;
- Organizational and managerial;
- Design and analytical.

### 3 Descriptors

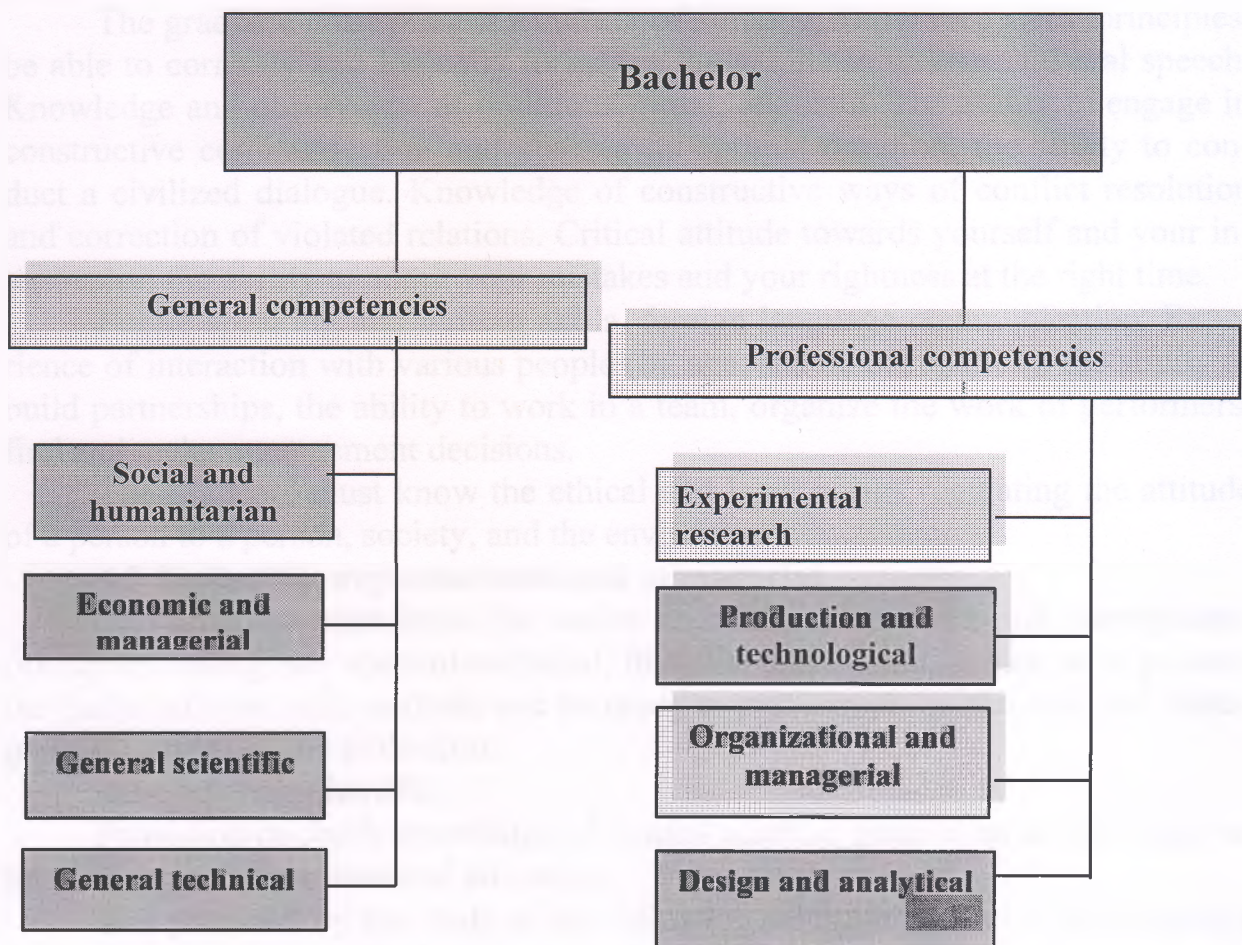
The field of professional activity of the Bachelor of the educational program "Mining Engineering" includes engineering support of human activity in the bowels of the Earth during operational development, extraction and processing of solid minerals, construction and operation of underground facilities for various purposes

The objects of professional activity of the bachelor 6B07205 - "Mining Engineering" are: the bowels of the Earth, including production facilities, equipment and technical systems for their development; equipment and technologies for ensuring safe and effective implementation of geotechnologies for extraction, processing of solid minerals and rational use of natural resources; mining machinery and equipment of various functional purposes (for open and underground mining); measures to ensure the safe operation of mining machinery and equipment and to reduce their anthropogenic load on the environment.

The subjects of professional activity of the bachelor 6B07205 - "Mining Engineering" are the improvement of mining technology, the development and creation of new mining equipment and technology, taking into account the needs of the mining and nuclear industry of the Republic of Kazakhstan



## Bachelor's degree structure



### 4 General competencies

#### 4.1 Social and humanitarian

Knowledge of the laws of socio-economic development of society, the history of Kazakhstan, the state language, foreign and Russian languages as means of interethnic communication.

Understanding the importance of their social functions as a citizen of their country, a member of society, a stable positive attitude to their public duties. Knowledge of the symbols of the state (coat of arms, flag, anthem).

Knowledge of human and civil rights and freedoms, the ability to implement them in various life situations. The ability to correlate their interests with the interests of society. The focus on the improvement and development of society based on the principles of humanism, freedom and democracy. Experience of socially useful civic activity. The presence of a certain life position and internal readiness for its implementation. The ability to take responsibility, participate in the functioning and improvement of democratic institutions. The need for self-



development. Knowledge and compliance with the norms of a healthy lifestyle, physical culture of a person, freedom and responsibility of lifestyle choice.

The graduate must possess a culture of thinking, know its general principles, be able to correctly and logically formalize the results in written and oral speech. Knowledge and observance of traditions, ritual, etiquette. The ability to engage in constructive communication and observe its optimal duration; the ability to conduct a civilized dialogue. Knowledge of constructive ways of conflict resolution and correction of violated relations. Critical attitude towards yourself and your interlocutor, the ability to admit your mistakes and your rightness at the right time.

Public speaking and writing skills, foreign language communication. Experience of interaction with various people (by age, status, occupation), the ability to build partnerships, the ability to work in a team, organize the work of performers, find and make management decisions.

The graduate must know the ethical and legal norms regulating the attitude of a person to a person, society, and the environment.

#### **4.2 Economic, organizational and managerial**

The graduate must know the basics of industrial relations and management principles, taking into account technical, financial and human factors, must possess the basics of economic analysis and be ready to perform organizational and managerial functions in the collection.

#### **4.3 General scientific**

Providing in-depth knowledge of natural science, general technical nature as the foundation of professional education.

It is provided by the study of the following disciplines: Higher Mathematics (differential and integral calculus, mathematical statistics), physics, chemistry, descriptive geometry and computer graphics.

Information competence should also be attributed to general scientific ones: computer literacy, mastery of new information and multimedia technologies (e-mail, Internet), the ability to critically treat information. The ability to navigate the information flow: the ability to find and systematize various sources of information according to a certain criterion; to use rational methods of obtaining, converting, systematizing and storing information, to actualize it in the necessary situations of intellectual and cognitive activity.

#### **4.4 General technical**

The bachelor must be competent in all matters related to the stages of the technological process, occupational safety in production, environmental protection.

It is provided by the study of the disciplines: thermodynamics and heat transfer, computer science, applied mechanics, resistance of materials, ecology and sustainable development, fundamentals of design and machine parts, materials science and technology of structural materials, friction and wear, electrical engineering, hydraulics.

The professional capabilities of a bachelor in modern conditions must meet the requirements of the global international labor market. The bachelor should be ready to change social, economic, professional roles, should be geographically and socially mobile in the conditions of increasing dynamism of changes and uncertainties.

### **5. Professional competencies**

The purpose of the cycle of profile disciplines (PD) is to study the key theoretical aspects of engineering and technology to ensure the safe and effective implementation of various technologies for the extraction, processing of solid minerals and rational use of natural resources.

#### **5.1 Settlement and project activities**

- formation of the goals and objectives of the project (program), providing a modern level of technology for the construction, operation and reconstruction of mining enterprises;
- collection and analysis of information source data for design;
- development of design documentation for construction, operation and reconstruction of mining enterprises;
- conducting a preliminary feasibility study of design calculations;
- implementation of projects in production and author's supervision.

#### **5.2 Production and technological activities**

- organization of the production process during the construction, operation and reconstruction of mining enterprises, various objects on the surface and underground;
- ensuring the performance of mining and construction works in accordance with projects, technical requirements and safety rules;
- selection of equipment and materials to ensure production processes;
- efficient use of materials, equipment, algorithms and programs for the selection and calculation of process parameters.

#### **5.3 Experimental research activities**

- collection and systematization of scientific and technical information of domestic and world experience in relation to solving problems of mining production;
- mathematical modeling of mining production processes and mining facilities based on standard packages of automated design and research;
- planning, conducting experiments according to specified methods, mathematical processing and analysis of the results.

#### **5.4 Organizational and managerial activities**

- organization, planning and management of mining and construction works;
- carrying out organizational and planned calculations for the creation (reorganization) of production sites;
- development of operational work plans of production divisions;



- preparation of initial data for the selection and justification of scientific, technical and organizational solutions based on economic calculations.

### **5.5 Functions of professional activity**

The bachelor in his professional activity performs the following functions:

- carrying out work on the preparation of technical documentation and established reporting according to approved forms;
- conducting training and instruction on safety, labor protection and the environment;
- monitoring of compliance with the requirements for the preparation of documentation on the quality management of technological processes at production sites.

### **5.6 Typical tasks of professional activity**

The bachelor should be prepared to solve the following typical tasks:

- by choosing a rational system for the development of statements;
- development and design of mining construction technology;
- selection of special software products in the field of mining industry;
- according to the choice of tunnel construction technology;
- according to the operating conditions of mining vehicles and equipment;
- on the choice of means of complex mechanization of technological processes;
- according to the regulatory documents regulating the design;
- on the composition and content of the project documentation;
- on the safe conduct of blasting operations and the design of warehouses of explosive materials.

### **5.7 Direction of professional activity**

- equipment and technologies for ensuring safe and effective implementation of geotechnologies for extraction, processing of solid minerals and rational use of natural resources;
- measures to ensure the safe operation of mining machines and equipment and to reduce their anthropogenic impact on the environment.

### **5.8 Content of professional activity**

The content of the EP "Mining Engineering" on the basis of 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 ensure:

- obtaining a full-fledged and high-quality professional education in the field of mineral deposits development (MPI), confirmed by the level of knowledge and skills, skills and competencies, based on the criteria established by the State Educational Standard, their assessment, both in content and in volume
- providing bachelor's degree training for the mining industry, who know the technology, complex mechanization, organization and economics of mining

production, methods and principles of its perfection and design. For example, highly mechanized coal mines of Ekibastuz (Bogatyr Komir LLP, Vostochny Section of Eurasian Energy Corporation JSC), enterprises of high-grade production based on iron ore deposits (Sokolov-sko-Sarbay Mining and Processing Production Association JSC) and uranium deposits under development (KazATOMPROM), etc.:

- 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;
- using methods of analysis and evaluation of experimental results;
- knowledge of modern problems of mining production;
- to promote the acquisition of practical skills in the development of minerals, mathematical processing of research results, drawing up technological passports of technological processes using modern information technologies;
- the ability to use methods, skills and modern technical means necessary in engineering practice;
- the ability to find and work with the necessary literature, computer information, databases and other sources of information to solve the tasks;
- to form students' teamwork skills, productive and ethical responsibility, the ability to understand the problem and to find solutions from working together with various specialists, the need to improve their knowledge and skills;
- the ability to work in a team on interdisciplinary topics, while showing individuality, and, if necessary, solve tasks independently;
- readiness of students for professional activity through disciplines that provide fundamental knowledge, skills and work skills in production, government organizations and educational institutions;
- be able to conduct analysis and monitoring, as well as make management decisions based on their results;
- have erudition, knowledge of modern social and political problems, speak state Russian and foreign languages, tools of the market economy, safety and environmental issues.

### **5.9 Requirements for the Bachelor's key competencies in OP 6B07205 - "Mining Engineering"**

A bachelor should have an idea:

- about the current state of production and ways of its development in the future;
- about the main scientific and technical problems of development and the current state of the mining and metallurgical industry;
- about packages of special software in the field of field design;



- on the system of legislative acts, ways and means of ensuring healthy and safe working conditions at industrial enterprises;

- about the main scientific and technical problems in working out the place of birth.

know:

- physical and mechanical properties of rocks;
- basic and auxiliary processes in the opening of mineral deposits;
- technological features of the production of stripping and mining operations on deposits using various types of mining and transport equipment;

- opening, preparation and field development systems;
- theoretical knowledge in the development of uranium deposits by the ISL method;

- modern technologies for the construction of engineering underground structures and tunnels;

- personnel requirements;
- requirements and content of project and technical documentation;
- methods and forms of technological repair;
- regulatory documents regulating the selection and operation of technological machines and equipment;
- the economy of the enterprise and industry, the scientific organization of labor;

- design stages

be able to:

- independently and reasonably select and calculate the necessary lining of the underground structure, if necessary, and temporary support;

- to form technological schemes of continuous, in-depth and combined development systems, to calculate the parameters of the elements of the development system, during the extraction of horizontal, inclined and steep-yielding deposits;

- in specific conditions, select the necessary enrichment method and the necessary equipment for this;

- to search for legal norms regulating the rights in the area of ownership, use and disposal of natural resources;

- competently analyze and evaluate the actions of subordinates, to control the moral climate in the team, to maintain the necessary level of labor and performance discipline;

- assess the impact of the operation of technological machines and equipment on the environment and determine the amount of damage.

have skills:

- computer work;

- use of research methods and instruments;

- application of the main regulatory documents, reference books when calculating the main parameters of mines and quarries;
- use of metrological rules and regulations;
- possession of methods of technical control in the conditions of existing production;
- rational methods of search and use of scientific and technical information;
- in the organization of safe working conditions and the elimination of accidents.

be competent:

- in the field of mining and metallurgical industry;
- in the field of industrial labor legislation.

### **5.10 The main national goals of education and the hierarchy of goals (by cycles of disciplines)**

Bachelor's degree in OP 6B07205 - "Mining Engineering" has the following objectives:

- to implement democratic principles of educational process management in practice, to expand academic freedom and opportunities of higher educational institutions;
- to ensure the adaptation of higher education in the specialty and scientific research to the changing needs of society and the achievements of scientific thought;
- to ensure recognition of the level of training of specialists in other countries;
- to ensure higher mobility of graduates in the changing conditions of the labor market.

The purpose of the cycle of general education disciplines (OOD) is to provide social and humanitarian education based on knowledge of the laws of socio-economic development of society, the history of Kazakhstan, modern information technologies, the state language, foreign and Russian languages as means of interethnic communication.

The purpose of the cycle of basic disciplines (OD) is to provide in-depth knowledge of natural science, general technical and economic nature as the foundation of vocational education.

The purpose of the cycle of profile disciplines (PD) is to study the key theoretical aspects of engineering and technology to ensure the safe and effective implementation of various technologies for the extraction, processing of solid minerals and rational use of natural resources.

### **5.11 Requirements for the level of education of graduates**

#### **5.11.1 Requirements for general education**

The main requirement for general education is that a graduate receives a full-fledged and high-quality professional education, confirmed by the level of know-



ledge, skills, skills and competencies based on the criteria established by the state mandatory standard, their assessment both in content and in volume.

#### 5.11.2 Requirements for social and ethical competence

The graduate must possess a humanitarian culture, ethical and legal norms of relations to man, society and the environment, a culture of thinking.

#### 5.11.3 Requirements for economic and organizational and managerial competencies

The graduate must master the basic laws of economic development, factors affecting the technical and economic efficiency of production, knowledge of sociology and psychology in enterprise management, the ability to qualitatively and quantitatively substantiate management decisions.

#### 5.11.4 Requirements for professional competence

The graduate must have professional knowledge in his subject area, know the basics of industrial relations and management principles, taking into account technical, financial and human factors.

The graduate must possess a knowledge system for the creation and application of modern technologies in his subject area, as well as in related fields; in accordance with his chosen educational trajectory and field of activity, he must have sufficient knowledge, skills, skills and competencies for competent development and solution of design, operational, experimental-research or design tasks in their subject area.

#### 5.11.5 Requirements for readiness to change social, economic, professional roles, geographical and social mobility in conditions of increasing dynamism of changes and uncertainties

The professional capabilities of a bachelor specialist in modern conditions should meet the requirements of the global international labor market. A bachelor specialist should be ready to change social, economic, professional roles, should be geographically and socially mobile in the conditions of increasing dynamism of changes and uncertainty.

#### 5.11.6 Requirements for education in the main cycles of academic disciplines

Requirements for education in the main cycles of educational disciplines they are determined by the specific content of the working curricula of the educational program. In order to acquire a set of professional, intercultural, communicative competencies, a graduate must master the knowledge of a set of general education (GED), basic (BD) and profile (PD) disciplines as their mandatory component, and a component of choice in accordance with the chosen trajectory of education in full (at least 135 credits), established by this state the standard.

## 6. Expected results by years of study:

### 1 year of study

The formation of the personality, ethical and legal foundations of the behavior of the student is carried out. The general provisions of the laws of socio-economic development of society, the history of the Kazakh state are being radically consolidated, knowledge of the state language, foreign and Russian languages is being improved and deepened (to the professional level). There is a further improvement of the apparatus of mathematical analysis and skills in natural science disciplines, the elements of computer graphics and the logical apparatus of descriptive geometry are being mastered for further transition to a deeper study of general scientific and general technical disciplines.

### 2 year of study

There is a further formation of the fundamental foundations of technical knowledge for this profession on the basis of in-depth study of applied mathematics and a deeper study of general scientific and general technical disciplines. Information competence is being strengthened: computer literacy, mastery of new information and multimedia technologies.

Masters the basics of industrial relations and management principles, taking into account technical, financial and human factors, the basics of economic analysis.

The skills and abilities acquired in the study of surveying, mining graphics, computer graphics are a necessary basis for studying special disciplines and mastering modern methods of calculations. The practice conducted by students in the workplace contributes to their acquisition of the necessary production skills.

### 3 year of study

The study of third-year disciplines provides deep theoretical knowledge of basic and specialized disciplines and is one of the stages of preparation for professional activity. The disciplines of specialization allow students to master modern methods and techniques of surveying with the use of high technologies and the latest software developments. Practical training in the position of a master or a mining technologist will allow you to master the main production processes

### 4 year of study

This course is the main one in training a specialist who meets the requirements of modern production. As a result of mastering the applied disciplines, the student is prepared both theoretically and practically to perform surveying work during the construction and operation of underground and surface structures in all areas of construction. Special attention in the preparation is paid to the organizations of the mining profession. At the pre-graduate practice, the student collects, analyzes and develops the material according to the individual task of the supervisor.



## Conclusion

Thus, in the competence model of a specialist, the goals of education are associated not only with the performance of specific functions, but also with integrated requirements for the result of the educational process. This approach covers, along with specific knowledge and skills, categories such as the ability and willingness to learn, social skills, etc.

Today, responsible decision-making takes place in complex dynamic conditions and most modern mining and metallurgical enterprises are forced to adapt quickly to these conditions, therefore, the competence of a modern specialist can be interpreted in the context of modern theory of self-organization, where they act as an important personal resource. Market conditions impose new requirements on graduates, among which the requirements of systemically organized, intellectual, communicative, self-organizing principles receive greater priority.

## Registration sheet for changes to

Sequence number of the change	Section, document item	Type of change (replace, cancel, add)	Number and date of notification	The change has been made	
				Date	Surname and initials, signature, position