

**NJSC «Kazakh national research technical university named after K.I. Satbayev»  
K. Turysov Institute of Geology and Oil-Gas Business  
Department of «Geological survey, prospecting and exploration of mineral  
deposits»**

**EDUCATIONAL PROGRAM**

**"GEOLOGY AND EXPLORATION OF MINERAL DEPOSITS"  
Bachelor of Engineering and Technology in the educational program "6B07202  
Geology and Exploration of Mineral Deposits «Geology and exploration of mineral  
deposits»**

1st edition  
in accordance with SCES of higher education of 2018

**Almaty 2022**

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

**From KazNRTU named after K. Satpayev:**

- |  |  |                 |
|--|--|-----------------|
| 1. Head of the department GSPaEMD            |  | А.А. Бекботаева |
| 2. Director of IGPI named after K.Turysov    |  | А.Х. СЫЗДЫКОВ   |
| 3. Chairman of the Department UMG, professor |  | А.Б. Байбатша   |



**From employers:**

1. Chief Scientific Officer of the Institute of Geological Sciences named after K.I. Satpaev, Candidate of Geological and Mineralogical Sciences Zhunusov AA
2. Director of ICC GEO LLP, active member of PONEN - Kabaziev BM
3. The head of the geological prospecting area of JSC Pustynnoe JSC "Altynalmas", candidate of geological and mineralogical sciences Rassadkin V.V.

**From partner university:**

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

Approved at the meeting of the Academic Council of the Kazakh National Research Technical University named after KI Satpayeva. Protocol №3 from 25.06.2021

**Qualification:**

Level 6 of the National qualifications framework:  
 6B07 Engineering, manufacturing and construction industries  
 6B072 Manufacturing and processing industries (Bachelor):  
 Geology and exploration of mineral deposits

**Professional competency:** Work in the geological industry, conducting geological exploration at all stages and phases of geological research, be competent in matters of geology and exploration of the subsoil, the state and prospects of development of the industry, the legal framework for subsoil use, as well as requirements for the quality of mineral raw materials and the conditions of world, regional and local markets.

## 1 BRIEF DESCRIPTION OF THE PROGRAM

Designed to carry out specialized training of bachelors in the educational program of the specialty "Geology and exploration of mineral deposits" at Satbayev University and was developed as part of the direction "Production and manufacturing industries".

This document meets the requirements of the following legislative acts of the Republic of Kazakhstan and regulatory documents of the Ministry of Education and Science of the Republic of Kazakhstan:

- 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 dated 04.07.18 № 171-VI.

- The Law of the Republic of Kazakhstan “On Amendments and Additions to Certain Legislative Acts of the Republic of Kazakhstan on the Expansion of the Academic and Management Independence of Higher Education Institutions” dated 04.07.18 №171-VI.

- Order of the Minister of Education and Science of the Republic of Kazakhstan dated 30.10.18, №595 “On approval of the Model Rules for the activities of educational organizations of the corresponding types”.

- The state compulsory standard of higher education (Appendix 7 to the order of the Minister of Education and Science of the Republic of Kazakhstan dated 31.10.18. №604.

- Decree of the Government of the Republic of Kazakhstan dated 19.01.12, №111 “On approval of the Model Rules for admission to study at educational organizations implementing educational programs of higher education” with amendments and additions from 14.07.16 № 405.

- Decree of the Government of the Republic of Kazakhstan dated 13.08.12, №1042 “On approval of the Concept for the development of the geological industry until 2030”.

- The Law on Subsoil and Subsoil Use and the draft Code on Subsoil and Subsoil Use.

- Code of public reporting on the results of exploration, mineral resources and reserves of KAZRC.

- The concept of the State Geological Exploration Program for 2021-2025, January 31, 2020.

- ‘National Qualifications Framework’, approved by the protocol of March 16, 2016 by the Republican tripartite commission on social partnership and regulation of social and labor relations.

- Sectoral qualifications framework “Geology of solid minerals, common minerals and groundwater” of the National qualification system of the Republic of Kazakhstan. Appendixes №67, 68, 70, 71, 74, 75, 76, 81, 82 to the order of Deputy Chairman of the Board of the National Chamber of Entrepreneurs of the Republic of Kazakhstan "Atameken" dated December 26, 2019 №263.

- *The purpose of the educational program of the specialty "Geology and exploration*

Designed by:	Reviewed: meeting of the Institute	Approved by: EMC KazNRITU	Page 3 of 118
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*of mineral deposits*" is preparation of highly qualified, competitive and sought-after specialists in the labor market for geological, surveying, mining enterprises of the Republic of Kazakhstan, capable of performing design, production, technological and organizational work at industrial enterprises in the region. Geology and exploration of mineral deposits includes: areas of science, engineering and technology, covering a set of problems associated with the development of the mineral resource base, based on the study of the Earth and its subsoil with the aim of forecasting, searching, exploration, exploitation of solid, liquid and gaseous minerals, engineering and geological surveys to meet the needs of the fuel, metallurgical, chemical industries, agricultural needs, construction, assessment of the ecological condition of the territories.

*Types of labor activity:*

- production and technological;
- organizational and management;
- experimental research;
- settlement and design and analysis

A bachelor in the specialty “Geology and exploration of mineral deposits”, depending on the type of professional activity, is prepared to solve the following professional tasks:

*a) production and technological activities:*

- design of technological processes for the study of natural accumulations of minerals at the stages of regional geological study, prospecting, exploration and development of mineral deposits;
- the solution of production problems in the field of geological, geochemical, environmental and geological work, office, laboratory and analytical studies;
- exploitation of modern field and laboratory equipment and instruments;
- registration of primary geological, geological-geochemical and geological-ecological documentation of field observations, testing of the soil and plant layer, rocks and minerals on the surface, in open, underground mine workings and wells, in surface and underground waters and underground air;
- keeping records of work performed and evaluating their economic efficiency;
- processing, analysis and systematization of field and trade geological, geochemical, ecological and geological information using modern methods of its automated collection, storage and processing;
- development of methodological documents in the field of geological survey, prospecting, exploration, operational work, geological and economic evaluation of mineral resources;
- implementation of measures for the safe conduct of exploration and protection of personnel and the environment at all stages of production;

*б) organizational and management:*

- organization, planning and management of exploratory, geological survey, exploration, geological support of mining operations;
- carrying out organizational and planned calculations to create geological and production sites;

- development of operational work plans for production units;
- preparation of initial data for the selection and justification of technical and organizational solutions based on economic calculations.

*б) experimental research:*

- collection and systematization of scientific and technical information of national and world experience in relation to solving geological problems;
- mathematical modeling of geological processes and geological objects based on standard computer-aided design and research packages;
- planning, conducting experiments using specified methods, mathematical processing and analysis of results.

*з) design and analysis:*

- formation of goals and objectives of the project (program) that provide a modern level of technology for conducting geological works;
- collection and analysis of information source data for design;
- conducting a preliminary feasibility study of project calculations;
- implementation of projects in production and author's supervision.
- implementation of technical design in the field of geological, geochemical and environmental mapping of territories, forecasting, search, exploration, development, geological, economic and environmental assessment of mineral objects, as well as objects associated with underground structures;
- preparation of geological, methodological, and production and technical sections of projects for the activities of production units as part of production teams and independently;
- development of technologies for conducting geological survey, search and exploration works on mineral objects and drawing up a geological task for their implementation.

*•Objects of professional activity of the graduate:*

- mineral natural resources (solid metal, non-metallic, liquid and gaseous), methods of their search and exploration,
- echnologies for studying crystals, minerals, rocks, deposits of solid, liquid and gaseous minerals, geological formations, the earth's crust, the lithosphere and the planet Earth as a whole;
- techniques and technologies for geological, mineralogical, geochemical, hydrogeological, engineering-geological mapping and cartography,
- technologies for forecasting, geological and economic assessment and exploitation of mineral deposits,
- equipment and technologies for the production of works on open and underground mines, quarries, mines, search, exploration and production wells,
- geographic information system – technology studies of subsoil,
- ecological functions of the lithosphere and the ecological state of mining areas of subsurface use.

## 2 SCOPE AND CONTENT OF THE PROGRAM

The amount of undergraduate is 254 credits regardless of the form of education, applied educational technologies, the implementation of bachelor programs using a network form of realization of the program of bachelor in the individual curriculum, including accelerated learning.

The content of the EP “Geology and exploration of mineral deposits” based on the development of a multi-level system of training, the fundamental nature and quality of training, the continuity and succession of education and science, the unity of training, education, research and innovation, aimed at maximum satisfaction of consumer needs should provide.:

- obtaining a full-fledged and high-quality professional education in the field of Geology of mineral deposits (MPI), confirmed by the level of knowledge and skills, abilities and competencies, their assessment, both in content and in volume
- providing training for bachelors in the geological industry who know the technology, organization and Economics of the geological industry, methods and principles of its improvement and design.
- training of professional and competitive specialists in the field of Geology, prospecting and exploration of mineral deposits;
  - ability to apply knowledge of mathematics, fundamental and technical sciences;
  - use of methods for analysis and evaluation of experimental results;
  - knowledge of modern problems of geology;
  - contribute to the acquisition of practical skills in search, exploration and development of minerals, mathematical processing of research results, drawing up technological passports of technological processes using modern information technologies;
  - the ability to use the techniques, skills and modern engineering tools necessary in engineering practical activities;
  - ability to find and work with the necessary literature, computer information, databases, and other sources of information to solve tasks;
  - to form students’ team work skills, production and ethical responsibility, the ability to understand the problem and find solutions from working with different specialists, and the need to improve their knowledge and skills;
  - ability to work in a team on an interdisciplinary subject, while showing individuality, and if necessary, solve problems independently;
  - readiness of students for professional activities through disciplines that provide fundamental knowledge, skills and abilities to work 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 issues, speak state, Russian, and foreign languages, tools of market economy, and issues of safety and environmental protection.

**Objectives of the educational program:**

- study of a cycle of *General education subjects* for providing social and humanitarian education based on the laws of social and economic development of society, history, modern information technologies, state language, foreign and Russian languages;
- study of the *basic disciplines* cycle to provide knowledge of natural science, General technical and economic disciplines as the Foundation of professional education;
- the cycle of *profile disciplines* is focused on the study of key theoretical aspects of Geology, search and exploration of solid, liquid and gaseous minerals, and rational use of natural resources;
- study of disciplines that form knowledge skills and abilities of planning and organization of research, design of geological works;
- familiarization with the technologies and equipment of enterprises during various types of practices.
- acquisition of skills in laboratory research, technological calculations, equipment selection and design using modern computer technologies and programs.

### 3 REQUIREMENTS FOR APPLICANTS

Admission of persons entering KazNRTU is carried out by placing a state educational order (educational grants), as well as paying for training at the expense of citizens' own funds and other sources.

Admission is carried out according to the applications of an applicant who has completed full secondary, secondary special education on a competitive basis in accordance with the points of the certificate issued by the results of the unified national testing (hereinafter – UNT) or complex testing. To participate in the competition, it is required to gain at least 65 points when entering a national University.

Special requirements for admission to the program if available, including for graduates of 12-year schools, colleges of applied bachelor's programs, etc.

Admission to the university of individuals who have technical and professional or post-secondary education with the qualification of “mid-level specialist” or “applied bachelor” in related areas of training of higher education personnel, providing for shorter training periods, is carried out according to the results of the UNT. (Model rules for admission to education organizations that implement educational programs of higher and postgraduate education dated October 31, 2018 № 600).

Rules for transferring credits for accelerated (reduced) education based on 12-year secondary, technical and higher education

Code	Type of competence	Description of competence	The result of the competence	Responsible
<b>GENERAL</b>				
(It implies full training with possible additional training depending on the level of knowledge)				
G1	Communicativeness	<ul style="list-style-type: none"> <li>- Fluent monolingual oral, written and communication skills</li> <li>- ability to communicate not fluently with a second language</li> <li>- Ability to use communicative interaction in different situations</li> <li>- there are basics of academic writing in the native language</li> <li>- diagnostic test for language level</li> </ul>	Full 4-year training with a minimum of 240 academic credits (including 120 contact classroom academic credits) with the possible transfer of credits in the second language where the student has an advanced level. The language level is determined by passing a diagnostic test.	Department of Kazakh and Russian languages, Department of English
G2	Mathematical literacy	- Basic mathematical thinking at the communication level – the ability to solve situational problems based on the mathematical apparatus of algebra and the principles of mathematical analysis	Full 4-year training with a minimum of 240 academic credits (including 120 contact classroom academic credits). At positive passing of the diagnostic	Department of mathematics
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		- diagnostic test for mathematical literacy in algebra	test the level is Mathematics 1, at negative – the level is Algebra and introduction to mathematical analysis	
G3	Basic literacy in natural science disciplines	<ul style="list-style-type: none"> <li>- basic understanding of the scientific picture of the world with an understanding of the essence of the basic laws of science</li> <li>- understanding basic hypotheses, laws, and methods, drawing conclusions, and evaluating errors</li> </ul>	Full 4-year training with a minimum of 240 academic credits (including 120 contact classroom academic credits). At positive passing of the diagnostic test level is Physics 1, General chemistry, at negative – level of The beginning of physics and Basic foundations of chemistry.	Departments in the areas of natural Sciences.

**SPECIFIC**

(it implies reduced training due to the transfer of credits depending on the level of knowledge on competencies for graduates of 12-year schools, colleges, universities, including humanitarian and economic areas)

S1	Communicativeness	<ul style="list-style-type: none"> <li>- Fluent bilingual oral, written and communication skills</li> <li>- ability to communicate not fluently with a third language</li> <li>- writing skills of various styles and genres</li> <li>- skills of deep understanding and interpretation of your own work of a certain level of complexity (essay)</li> <li>- basic aesthetic and theoretical literacy as a condition for full-fledged perception and interpretation of the original text</li> </ul>	Full credit transfer by language (Kazakh and Russian)	Department of Kazakh and Russian language
S2	Mathematical literacy	<ul style="list-style-type: none"> <li>- Special mathematical thinking using induction and deduction, generalization and concretization, analysis and synthesis, classification and systematization, abstraction and analogy.</li> <li>- ability to formulate, justify, and prove statements</li> <li>- application of General mathematical concepts, formulas, and extended spatial perception for mathematical problems</li> </ul>	Transfer of credits in the Mathematics discipline (Calculus) I	Department of Mathematics

		- complete understanding of the mathematical analysis basics		
S3	Special literacy in natural science disciplines (Physics, Chemistry)	<ul style="list-style-type: none"> <li>- Broad scientific perception of the world, which implies a deep understanding of natural phenomena</li> <li>- critical perception for understanding the scientific phenomena of the surrounding world</li> <li>- cognitive abilities to formulate a scientific understanding of the forms of existence of matter, its interaction and manifestations in nature</li> </ul>	Transfer of credits in the Physics I, General chemistry	Departments in the areas of natural Sciences
S4	English	<ul style="list-style-type: none"> <li>- readiness for further self-study in English in various fields of knowledge</li> <li>- readiness to gain experience in project and research work using English</li> </ul>	Transfer of English language credits from academic to professional level (up to 15 credits)	Department of English
S5	Computer skills	<ul style="list-style-type: none"> <li>- Basic programming skills in one modern language</li> <li>- using software and applications for training in various disciplines</li> <li>- availability of a global standard language level certificate</li> </ul>	Transfer of credits in discipline Introduction to information and communication technologies, Information and communication technologies	Department of software engineering
S6	Social and humanitarian competencies and behavior	<ul style="list-style-type: none"> <li>- understanding and awareness of the responsibility of each citizen for the development of the country and the world</li> <li>- Ability to discuss ethical and moral aspects in society, culture, and science</li> </ul>	Transfer of credits in Contemporary history of Kazakhstan (except for the state exam)	Department of social Sciences
		<ul style="list-style-type: none"> <li>- Critical understanding and the ability to dispute for debates on contemporary scientific hypotheses and theories</li> </ul>	Transfer of credits in philosophy and other humanitarian disciplines	
<b>PROFESSIONAL</b> (it implies reduced training due to the transfer of credits depending on the level of knowledge on competencies for graduates of colleges, secondary schools, universities, including humanitarian and economic areas)				
P1	Professional competence	<ul style="list-style-type: none"> <li>- critical perception and deep understanding of professional competencies at level 5 or 6</li> <li>- Ability to discuss and polemize on professional issues within the framework of the mastered program</li> </ul>	Transfer of credits in basic professional disciplines, including general and historical geology, crystallography and mineralogy,	Graduating department

			petrography, structural geology, educational and industrial practice	
P2	General engineering competencies	<ul style="list-style-type: none"> <li>- basic general engineering skills and knowledge, ability to solve general engineering tasks and problems</li> <li>- be able to use application packages for processing experimental data, solving systems of algebraic and differential equations</li> </ul>	Credit transfer for general engineering disciplines (Engineering graphics, descriptive geometry, Drilling of the wells and etc.)	Graduating department
P3	Engineering and computer competence	- basic skills of using computer programs and software systems for solving general engineering tasks	Credit transfer in the following disciplines: computer graphics, fundamentals of CAD, fundamentals of CAE and etc.	Graduating department
P4	Engineering Competencies	- skills and abilities of using technical means and experimental devices for solving general engineering problems	Transfer of credits in academic disciplines of the experimental direction: mineralogy and etc.	Graduating department
P5	Social-economic competencies	<ul style="list-style-type: none"> <li>- Critical understanding and cognitive ability to reason on contemporary social and economic issues.</li> <li>- A basic understanding of the economic valuation of objects of study and the profitability of industry projects</li> </ul>	Recount of credits in social - humanitarian and technical-economic disciplines to offset the elective cycle	Graduating department

The university may refuse to re-credit if the low diagnostic level is confirmed or the final grades for completed disciplines were lower than A and B.

#### **4. REQUIREMENTS FOR COMPLETING STUDIES AND OBTAINING A DIPLOMA**

- A graduate of this educational program is awarded the academic degree “Bachelor of Engineering and Technology”.

- Graduated bachelors must have depth knowledge and skills in the field of geology, prospecting and exploration for deposits of solid, liquid and gaseous minerals. They should have practical experience based on the study of basic and specialized disciplines, and the study of the methodology during the passage of all types of practices. They should have the knowledge and skills to analyze the methodology and identify existing problems. Graduates should be able to develop work programs for various types of geological work.

- Bachelors must have communication skills to be able to present their ideas and information, orally and in writing form. The specialist should be able to present graphical information in the form of drawings, tables, slides and drawings. He must be competent in the search and interpretation of technical information using various search system (patent search, literature review of magazines and books, the Internet).

- Bachelors should be socially mobile, be able to adapt to new situations in a professional environment.

- Bachelors should be able to organize cooperation in a team, show creativity and breadth of interests in order to solve interdisciplinary problems. A specialist must be tolerant, capable of criticism and self-criticism, and be prepared to accept the role of team leader and have the skills of interaction and cooperation. A graduate must have an ethical education and the need for his development through self-improvement and learning throughout life.

- Bachelors should have a good knowledge of Kazakh, Russian and foreign languages, be able to work in the international community, maintain ethical rules in society, at work and in interpersonal communication. They must demonstrate skills in achieving goals, solving problems in unusual situations. Specialists should take care of environmental protection and, while improving their qualifications, serve the development of the welfare of the whole society.

- Bachelors should have: good communication skills, appreciate the traditions of other cultures, their diversity in modern society, fundamental basic education, economic, social and legal training.

## 5 CURRICULUM WORK PLAN



MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF KAZAKHSTAN  
 KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY named after S. SATPAEV



APPROVED  
 Chairman of the Management Board  
 Rect. of the University named after K. Satpayev  
 M.M. Digezbaev  
 2022 г.

**CURRICULUM**  
 of Educational Program on enrollment for 2022-2023 academic year  
 Educational program 4807203 - "Geology and exploration of mineral deposits"  
 Group of Educational programs 0371 - "Mining and extraction of minerals"

Form of study: full-time		Duration of study: 4 years		Academic degree: Bachelor of Engineering and Technology																			
Discipline code	Name of disciplines	Cycle	Total amount in credits	Total hours	Classroom amount (credit/hr)	MS (including TMS) in hours	Form of control	Allocation of face-to-face training based on courses and semesters															
								I course		II course		III course		IV course									
								1 semester	2 semester	3 semester	4 semester	5 semester	6 semester	7 semester	8 semester								
<b>CYCLE OF GENERAL EDUCATION DISCIPLINES (GED)</b>																							
<b>M-1. Module of language training</b>																							
LNG 108	English language	GED, RC	10	300	09/6	210	E	5	5														
LNG 104	Kazakh (Russian) language	GED, RC	10	300	09/6	210	E	5	5														
<b>M-2. Module of physical training</b>																							
KPK 101-104	Physical Culture	GED, RC	8	240	09/8	120	D/credit	2	2	2	2												
<b>M-3. Module of information technology</b>																							
CSE 637	Information and communication technologies (in English)	GED, RC	5	150	21/0	105	E			5													
<b>M-4. Module of socio-cultural development</b>																							
HUM 100	Modern History of Kazakhstan	GED, RC	5	150	10/2	105	SE	5															
HUM 132	Philosophy	GED, RC	5	150	10/2	105	E		5														
HUM 120	Socio-political knowledge module (sociology, politicalology)	GED, RC	3	90	10/1	60	E			3													
HUM 134	Socio-political knowledge module (culturalogy, psychology)		5	150	10/1	105	E				5												
<b>M-5. Module of anti-corruption culture, ecology and life safety base</b>																							
HUM 133	Fundamentals of anti-corruption culture	GED, CCH	5	150	20/1	105	E						5										
MNG 488	Fundamentals of Entrepreneurship and Leadership																						
CHE 856	Ecology and life safety																						
<b>CYCLE OF BASIC DISCIPLINES (BD)</b>																							
<b>M-6. Module of physical and mathematical training</b>																							
MAT 101	Mathematics I	BD, UC	5	150	10/2	105	E	5															
PHY 468	Physics	BD, UC	5	150	11/1	105	E	5															
MAT 102	Mathematics II	BD, UC	5	150	10/2	105	E		5														
<b>M-7. Basic geological training module</b>																							
GEN429	Engineering and computer graphics	BD, UC	5	150	10/2	105	E		5														
GEO194	General geology	BD, UC	4	120	21/0	75	E	4															
GEO432	Structural geology	BD, UC	5	150	21/0	105	E		5														
GEO196	Crystallography and mineralogy	BD, UC	6	180	22/0	120	E			6													
GEO434	Petrography	BD, UC	5	150	12/0	105	E				5												
GEO439	Sedimentology	BD, UC	5	150	21/0	105	E			5													
CHE405	Chemistry	BD, UC	5	150	11/1	105	E			5													
GEO435	Geology and Mineral Resources of Kazakhstan	BD, UC	5	150	21/0	105	E				5												
MAP113	Geodesy with the basics of topography	BD, UC	5	150	21/0	105	E				5												
GEO436	Geoinformation technologies in geology	BD, UC	5	150	21/0	105	E			5													
GEO411	Geophysical methods of prospecting and exploration	BD, UC	5	150	21/0	105	E				5												
PEI406	Drilling of the wells	BD, UC	5	150	21/0	105	E				5												
3218	Electives	BD, CCH	5	150	21/0	105	E				5												
3219	Electives	BD, CCH	5	150	21/0	105	E				5												
GEO530	Geology of mineral deposits	BD, UC	5	150	21/0	105	E				5												
GEO429	Fundamentals of prospecting and exploration of mineral deposits	BD, UC	5	150	21/0	105	E					5											
GEO197	Paleontology and historical geology	BD, UC	4	120	21/0	75	E					4											
GEO428	Mathematic methods in geology	BD, UC	5	150	20/1	105	E					5											
4320	Electives	BD, CCH	6	180	21/1	120	E									6							
AAP184	Educational geological survey practice	BD, UC	2							2													
<b>CYCLE OF PROFILE DISCIPLINES (PD)</b>																							

M-8. Module of professional geological training															
GEO493	Oil and Gas Geology	PD, UC	4	120	2/0/1	75	E			4					
GEO443	Fundamentals of subsoil	PD, UC	5	150	2/0/1	105	E			5					
GEO492	Hydrogeology and engineering geology	PD, UC	4	120	2/1/0	75	E			4					
4305	Electives	PD, CCH	6	180	2/2/0	120	E			6					
4306	Electives	PD, CCH	5	150	2/0/1	105	E			5					
4307	Electives	PD, CCH	5	150	2/0/1	105	E			5					
4308	Electives	PD, CCH	6	180	2/0/1	120	E			6					
4309	Electives	PD, CCH	5	150	2/0/1	105	E			5					
4310	Electives	PD, CCH	5	150	2/0/1	105	E			5					
4311	Electives	PD, CCH	5	150	2/0/1	105	E			5					
4312	Electives	PD, CCH	5	150	2/0/1	105	E			5					
AAP143	Industrial internship I	PD, UC	2						2						
CIV786	Industrial internship II	PD, UC	3						3						
M-9. Module of final attestation															
ECA003	Preparation and writing of a thesis (project)	FA	6							6					
ECA103	Defense of the thesis (project)	FA	6							6					
M-10. Module of additional types of training															
AAP500	Military affairs	ATT	0												
<b>Total based on UNIVERSITY:</b>								31	29	31	29	30	30	33	27
								60	60	60	60				

Number of credits for the entire period of study					
Cycle code	Cycles of disciplines	Credits			Total
		required component (RC)	university component (UC)	component of choice (CCH)	
GED	Cycle of general education disciplines	51		5	56
BD	Cycle of basic disciplines		91	21	112
PD	Cycle of profile disciplines		18	42	60
	<b>Total for theoretical training:</b>	<b>51</b>	<b>109</b>	<b>68</b>	<b>228</b>
FA	final attestation	12			12
	<b>TOTAL:</b>	<b>63</b>	<b>109</b>	<b>68</b>	<b>240</b>

Decision of the Academic Council of KazNRTU named after K.Satbayev, Protocol № 13 от "28" 04 2022 г.

Decision of the Educational and Methodological Council of KazNRTU named after K.Satbayev, Protocol № 7 от "28" 04 2022 г.

Decision of the Academic Council of the Institute, Protocol № 4 от "30" 12 2021 г.

Vice-Rector for Academic Affairs



B. Zhautikov

Institute Director



A. Syzdykov

Department Head



A. Bekbotayeva

Representative of the Council from employers



A. Zhunusov



**MAJOR ELECTIVE DISCIPLINES educational program for the 2022-2023 academic year admission**  
**Educational program 6B07202 - "Geology and exploration of mineral deposits"**  
**Group of Educational programs 8071 - "Mining and extraction of minerals"**

Full-time study Study duration : 4 years Academic degree: bachelor of engineering and technology										
Year of study	Code of elective	Code of discipline	Name of discipline	semester	Cycle	Credits	Total hours	lec/lab/pr	S/W (including S/W/T) In hours	
<b>Basic geological training module</b>										
3	3218	GEO 440	Geological mapping	5	B	5	150	2/0/1	105	
		GEO 614	Physics of oil reservoir					2/0/1		
	3219	GEO 441	Crystallography	5	B	5	150	1/2/0	105	
GEO 442		Lithology, diagenesis and biofacies of oil and gas complexes	2/0/1							
4	4220	GPH 418	Theoretical bases and applied aspects of well logging	7	B	6	180	2/0/2	120	
		GPH 419	Geophysical exploration (well logging) of uranium deposits					2/0/2		
		GPH 420	Modern geophysical technologies for calculating reserves of uranium deposits					2/0/2		
		MIN 315	Mining					2/0/2		
<b>Module of professional geological training</b>										
4	4305	GEO 494	Geological and industrial types of mineral deposits	7	S	6	180	2/0/2	120	
		GEO 495	Geodynamics of lithospheric plates					2/0/2		
	4306	GEO 451	Computer technologies in geology	7	S	5	150	1/2/0	105	
		GEO 462	Oil and gas areas in Kazakhstan					2/0/1		
		GEO 447	Oil and gas provinces of the world					2/0/1		
	4307	GEO 453	Geochemical methods of exploration of mineral deposits	7	S	5	150	2/0/1	105	
		GEO 456	Theoretical basis for searching and exploration of oil and gas fields					2/0/1		
	4308	GEO 496	Laboratory Methods of studying minerals	7	S	6	180	2/2/0	120	
		GEO 497	Geodynamics of oil and gas pools					2/0/2		
	4309	GEO 454	Geological and economic evaluation of mineral deposits	7	S	5	150	2/0/1	105	
		GEO 449	Oil and gas geology and estimation of reserves					2/0/1		
	4310	GEO 458	Mine geology	8	S	5	150	2/0/1	105	
		GEO 459	Geochemistry of organic matter and hydrocarbons of oil and gas basins					2/0/1		
	4311	GEO 461	Geomorphology and anthropogenic geology	8	S	5	150	2/0/1	105	
		GEO 460	Computer modeling of oil and gas fields					2/0/1		
4312	GEO 455	Fundamentals of geotectonics	8	S	5	150	2/0/1	105		
	NSE 185	Theory and practice of project management					2/0/1			
	GEO 450	Geologic basis of oil and gas field development					2/0/1			
<b>Module "R&amp;D"</b>										
4312	4307	GEO 624	Methods of laboratory research of organic matter, oil and gas	7	S	5	150	1/1/1	105	
		GEO 609	Innovative methods of geological exploration					2/0/1		
		GEO 604	Microscopic studies of minerals and rocks					1/2/0		
4312	GEO 625	Petrography of sedimentary rocks of oil and gas bearing regions of Kazakhstan		8	S	5	150	2/0/1	105	

Credits numbers of elective disciplines over the entire period of study		
Cycle of disciplines		Credits
Cycle of basic disciplines (B)		21
Cycle of special disciplines (S)		42
Overall:		63

Decision of the Academic Council of the IG&PE, Minutes # 4, dated 30.12.2021.

Head of the department "Geological mapping, prospecting and exploration of mineral deposits"

A. Bekbotayeva

Representative of the Council from employers

A. Zhunusov

## 6 GRADUATE COMPETENCY FRAMEWORK

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6.1. At the university, based on achieving the learning outcomes for each discipline, the main learning descriptors based on Dublin descriptors have been adopted:

a. Knowledge and understanding - by demonstrating knowledge and understanding in the field of study formed on the basis of secondary education, including certain advanced knowledge in the field of study;

b. Application of knowledge and understanding - by applying their knowledge and understanding of actions that indicate a professional approach to the profession through a set of competencies demonstrated through the formation and justification of arguments and solutions to problems in the field of study;

c. Expression of judgments and analysis of actions - by accumulating, evaluating, processing and interpreting data, knowledge and skills in order to develop independent judgments taking into account the analysis of social, ethical and scientific considerations;

d. Communicative abilities and IT skills - by transferring real and virtual information, problems, their solutions, ideas, their implementation to both specialists and non-specialists in the field of study;

e. Self-learning and existential skills - by developing skills of self-study and retraining with a high degree of autonomy in the field of study and related fields.

6.2. At the university, based on the achievement of learning outcomes in each discipline, the main framework competencies are adopted:

a. Natural-scientific and theoretical-worldview competencies;

b. Social and personal competencies;

c. General engineering professional competencies;

d. Communicative and IT virtual competencies;

e. Special professional competences, including additional ones (Minor).

6.3. At the university, on the basis of training descriptors and basic framework competencies, the following framework characterization of graduate competencies is adopted, which guarantees the achievement of a competitive level in the professional market.

6.4. Based on the specified competency framework of a university graduate, EP moderators form the results of training, competencies, sub competencies and the EP competency matrix.

6.5. Based on the specified competency framework of a university graduate, departments and teachers form the learning outcomes, competencies, sub competencies and competency matrix of a readable discipline.



Competencies	Natural-scientific and theoretical-worldview	Socio-personal and civil	General engineering and professional competencies	Intercultural and communicative competencies	Specialized Professional Competencies
learning descriptors	<div style="border: 2px solid red; padding: 10px;"> <div style="border: 2px solid blue; padding: 10px; display: inline-block;">           Minimum Frame         </div> <div style="margin-left: 20px; text-align: center;">           bachelor         </div> <div style="margin-left: 20px; text-align: center;">           Bachelor (1st cycle)         </div> <div style="text-align: right; margin-top: 20px;">           Max frame         </div> </div>				
Knowledge and understanding					
Application of knowledge and understanding					
Communicative and creative abilities					
Self learning					

## 7 COMPETENCY BUILDING PROCESS

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7.1. Discipline (Course unit) - an independent, formally structured teacher format for teaching with a clear set of learning outcomes, training activities in the context of time and sequence with assessment criteria allow the student to successfully complete the discipline to accumulate the depth of competencies expressed in the amount of credits earned.

7.2. Learning outcome - a provision that a student should know, understand and be able to do at the end of the discipline, assessed by clear and transparent assessment criteria. The results of training in each discipline should be aimed at achieving one or more competencies of the graduate, noted in section 6.2.

7.3. Assessment criteria - clear descriptions for the student to understand what the student should do at each level of assessment to maximize learning outcomes. Evaluation methods and criteria for elements of the discipline must meet and be consistent with the learning outcomes of the training activities described during the development of the discipline.

7.4. Competency - the ability of a student (graduate) to use knowledge, skills and personal, social, methodological abilities in professional situations, as well as in personal development. The main competencies of the graduate are described in section 6.2 and the achievement of one or more of them is the goal of any university discipline.

7.5. Descriptors - the learning outcomes required for a student to achieve graduate competencies reflect the depth of such achievement by the student. The university has accepted descriptors, as reflected in Section 6.1, and are similar to the Dublin descriptors of European higher education.

7.6. Credits - Express the volume of mastering the discipline in whole numbers at a university or other educational infrastructure, from the normatively approved by the university, by transferring loans. Credits allow the student to accumulate the amount of loans to achieve certain qualifications specified in chapter 8.

7.7. Unit competency matrix - The results of the discipline should lead to the achievement of competencies (competencies) in the competency matrix of the graduate of section 6.3.

7.8. Module (Cycle) - a certain set of disciplines expressing a single set of competencies completes the development of a certain level of qualification of a student (graduate).

7.9. Module competency matrix (Cycle competency matrix) - The results of module training should lead to the achievement of competencies above the minimum level of development of the module.

7.10. Applied Undergraduate General Engineering (Associate Degree, Short Cycle) - qualification assigned by the university if the student exceeds the minimum competence of the graduate in the amount of at least 124 credits of theoretical education with a diploma according to section 8.

7.11 Bachelor of the second specialty (Minor) - Qualification awarded by a university if a student exceeds the minimum framework of professional competencies of

a graduate for credits of theoretical study in another educational program with a diploma according to section 8.

7.12. Undergraduate (Academic Degree, 1st Cycle) - a qualification assigned by a university when a student reaches the maximum competence of a graduate in the amount of at least 240 credits of theoretical education with a diploma according to section 8.

## 8 COMPETENCIES ACQUIRED BY STUDENTS IN THE DEVELOPMENT OF THE EDUCATIONAL PROGRAM "GEOLOGY AND EXPLORATION OF MINERAL DEPOSITS"

<b>General cultural competencies (GCC)</b>			
GCC 1	Ability to communicate verbally and in writing form in the state, Russian and foreign languages for solving problems of interpersonal and intercultural interaction		
GCC 2	Understanding and practical use of the norms of a healthy lifestyle, including prevention, the ability to use physical culture to optimize working capacity		
GCC 3	The ability to analyze the main stages and patterns of the historical development of society for the formation of a civic position		
GCC 4	The ability to use the basics of philosophical knowledge to form a worldview position		
GCC 5	The ability to critically use the methods of modern science in practice		
GCC 6	Awareness of the need and the acquisition of the ability to learn independently and improve their skills throughout their working lives		
GCC 7	Knowledge and understanding of professional ethical standards, proficiency in professional communication techniques		
GCC 8	The ability to work in a team, tolerantly perceiving social, ethnic, religious and cultural differences		
GCC 9	The ability to use the basics of economic knowledge in various fields		
<b>General professional competences (GPC)</b>			
GPC -1	Ability to acquire new knowledge with a high degree of independence using modern educational and information technologies, possession of computer skills with basic programming sufficient for professional activities		
GPC -2	Knowledge of the basic methods, methods and means of obtaining, storing, processing information, the ability to use modern technical means and information technologies to solve communicative problems using traditional storage media, distributed knowledge bases, and information in global computer networks		
GPC -3	Knowledge and understanding of the structure of crystals, the ability to determine minerals, rocks, the genesis and order of crystallization of minerals in rocks, analysis and restoration of thermodynamic conditions for the formation of rocks, mineralogenic, hydrocarbon, hydrogeological, geocological and engineering-geological systems		
GPC -4	Understanding and analyzing geological maps of various contents (tectonic, geomorphological, minerals, hydrogeological, oil and gas, geocological, geotechnical, etc.), understanding the patterns of spatial distribution of regional and local structural elements of the earth's crust.		
<b>Professional Competencies (PC)</b>			
P	Professional competences, including according to the requirements of industry professional standards, providing deep theoretical knowledge and practical skills in the field of geology and exploration of mineral deposits		
PC 1	Knowledge and use of technologies for geological surveying, prospecting, exploration, assessment, operational, production, hydrogeological, engineering and survey, geocological, mineralogical, petrological work and the requirements for the quality of geological materials, rules for maintaining and processing geological documentation.		
PC 2	Knowledge, the ability to choose and justify the methods of prospecting and exploration		
Designed by:	Reviewed: meeting of the Institute	Approved by: EMC KazNRITU	Page 20 of 118

	of mineral deposits (geochemical, lithological, geophysical, mineralogical, petrographic, lithological, etc.), the ability to determine and identify criteria and search features, based on the analysis, the ability to highlight promising regions and structures for various types of minerals (oil, gas, groundwater, solid minerals, including radioactive and rare earth elements)
PC 3	Knowledge of the types, technical characteristics, rules of operation, maintenance and metrological support of equipment, instruments, apparatus used in conducting geological, hydrogeological, engineering and geological research, skills in working with microscopes (polarizing, electronic), instruments for the geochemical study of the composition of minerals, rocks , ores (express analysis of the composition of rocks and minerals - spectrometers, X-ray structural analyzers, etc.)
PC 4	Knowledge, ability to choose and justify research methods for minerals, rocks, minerals, paleontological residues, hydrocarbon substances, groundwater, abilities and skills to apply different types of research methods, the ability to compare, analyze the results and make conclusions, to prepare reports on research methods
PC 5	Knowledge of the genesis, conditions of occurrence of minerals, understanding of the relationship, analysis of the conditions for the formation of oil, gas, groundwater, solid minerals, the era of ore formation; migration, concentration and conservation of ore components, hydrocarbons, groundwater in structural tectonic, stratigraphic, lithological and sedimentation traps
PC 6	Knowledge, understanding of the principles of testing methods for various types of solid minerals, calculation of reserves of studied types of minerals. The ability to solve the problems of geological work using innovative technologies (modeling of geological objects and calculation of reserves in the programs Micromine, Leapfrog, Petromod, Petrel, etc.).
PC 7	The ability to use knowledge of the legislation on subsoil and subsoil use of the Republic of Kazakhstan, international standards of geological documentation, other regulatory documents in professional activities. Knowledge of the state and prospects of the development of the mineral resource base of the region, the ability to use knowledge of the economy of mineral raw materials and exploration work to draw up feasibility studies, work programs
PC 8	Geoinformation systems, graphic systems, specialized office application packages (ArcGis, MapInfo, and others) used in geology, hydrogeology, oil and gas geology, engineering geology, geoecology. The ability to use advanced domestic and foreign experience in processing data from geological works: statistical data, data from regional geochemical, geological, hydrogeological studies to compile maps of the distribution of minerals in space and to identify patterns of their distribution in the earth's crust.

### Matrix of competencies of the educational program "Geology and exploration of mineral deposits"

Discipline Index	Name disciplines	general cultural									General professional				Professional							
		OK-1	OK-2	OK-3	OK-4	OK-5	OK-6	OK-7	OK-8	OK-9	OPK-1	OPK-2	OPK-3	OPK-4	PC-1	PC-2	PC-3	PC-4	PC-5	PC-6	PC-7	PC-8
<b>Cycle of general education discipline(OOD)</b>																						
LNG 108	Foreign language	x		x		x	x	x	x													
LNG 104	Kazakh (Russian) language	x		x		x	x	x	x													
KFK101-104	Physical culture 1-4																					
CSE 174	Information and Communication Technologies ( eng )										x	x										<b>X</b>
HUM100	Modern history of Kazakhstan			x	x				x													
HUM1 32	Philosophy			x	x	x			x	x												
HUM120	Socio-political knowledge module (sociology, political science )			x	x				x													
HUM134	Module of socio-political knowledge (culturology, psychology )				x				x													
HUM133	Fundamentals and anti-corruption culture					x			x	x	x											
HUM127	Sociology			x	x	x			x													
MNG 4 88	Fundamentals of Entrepreneurship and Leadership		x	x													x				<b>X</b>	
SNE656	Ecology and life safety			x	x	x			x													
<b>Cycle of basic disciplines (DB)</b>																						
MAT 1 01	Mathematics I										x	x										
MAT 1 02	Mathematics II										x	x										
PHY468	Physics												x		<b>X</b>							
GEN429	Engineering and computer graphics										x	x		x								
GE0194	General geology												x		x	x	x					
GEO432	Structural geology													x	x	x	x					
GE0433	Crystallography and mineralogy												x			x	x					
GE0434	Petrography												x		x	x	x					

Discipline Index	Name disciplines	general cultural									General professional				Professional							
		OK-1	OK-2	OK-3	OK-4	OK-5	OK-6	OK-7	OK-8	OK-9	OPK-1	OPK-2	OPK-3	OPK-4	PC-1	PC-2	PC-3	PC-4	PC-5	PC-6	PC-7	PC-8
GE0439	Sedimentology												x			x	x	x				
CH495	general chemistry																x	x				
GE0435	Geology and mineral resources of Kazakhstan												x	x	x		x			x		x
MAR113	Geodesy with the basics of topography														<b>X</b>	<b>X</b>	<b>X</b>					<b>X</b>
GEO436	Geoinformation technologies in geology											x	x		x					x		x
GE0411	Geophysical methods of prospecting and exploration												x	x	x		x	x			x	
PET406	Drilling of the wells													x		x	x	x				
GE0438	Geology of mineral deposits													x	x				x			
GE0429	Fundamentals of prospecting and exploration of mineral deposits												x	x	x	x	x			x	x	
GE0197	Paleontology and historical geology												x		x	x					x	
GE0428	Mathematical Methods in Geology											x	x			<b>X</b>						<b>X</b>
AAP164	Educational geological survey practice													x	x	x	x	x	x		x	
<b>Cycle of major disciplines (PD)</b>																						
GE0445	Oil and gas geology														x	x	x	x	x		x	
GE0443	Fundamentals of subsoil use													x		x	x					x
GE0430	Hydrogeology with the basics of engineering geology															<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>			
AAP143	Field trip I																					
AAP163	Field trip II																					
Module final certification																						
ECA101	Preparation and writing of the thesis (project)	<b>X</b>	X	X	X	X	X	X	X	X	X	X	X	X	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	X	X	X	X
ECA102	Thesis defense (project)																					
Module of additional types of training																						
AAP500	Military training																					
<b>Elective courses</b>																						
GE0440	Geological mapping											x	x		x	x	x	x				
GE0614	Reservoir Physics														x					x		
GE0441	Crystal optics															x	x	x				
GE0442	Lithology, diagenesis and biofacies of oil and															x	x	x	x			

Discipline Index	Name disciplines	general cultural									General professional				Professional							
		OK-1	OK-2	OK-3	OK-4	OK-5	OK-6	OK-7	OK-8	OK-9	OPK-1	OPK-2	OPK-3	OPK-4	PC-1	PC-2	PC-3	PC-4	PC-5	PC-6	PC-7	PC-8
	gas basins																					
G.P.H. 418	Theoretical foundations and applied aspects of GIS														X	X						X
GPH419	Geophysical surveys of wells of uranium deposits														X	X	X	X				X
GPH420	Modern geophysical technologies in the calculation of reserves of fields										x	x			X	X	X	X				X
MIN515	Mining															x		x	x			
GEO494	Geological and industrial types of mineral deposits															x		x	x			
GEO495	Geodynamics of lithospheric plates																x					
GEO451	Computer technologies in geology											x	x		x						x	x
GEO462	Oil and gas regions of Kazakhstan																				x	
GEO447	Oil and gas bearing provinces of the world																				x	
GEO453	Geochemical methods of prospecting for mineral deposits											x	x		X	X	X	X				X
GEO456	Theoretical foundations of prospecting and exploration of oil and gas fields																				x	x
GEO496	Laboratory methods for researching minerals																					
GEO497	Geodynamics of oil and gas basins														X							
GEO454	Geological and economic assessment of mineral deposits																					
GEO449	Oil and gas geology and reserves estimation																					
GEO458	Mine geology																					
GEO459	Geochemistry of organic matter and hydrocarbons in oil and gas basins																					
GEO461	Geomorphology and geology of the Anthropogen																					
GEO460	Computer modeling of oil and gas fields																					
GEO455	Fundamentals of geotectonics																					
NSE185	Theory and practice of project management																					



Discipline Index	Name disciplines	general cultural									General professional				Professional							
		OK-1	OK-2	OK-3	OK-4	OK-5	OK-6	OK-7	OK-8	OK-9	OPK-1	OPK-2	OPK-3	OPK-4	PC-1	PC-2	PC-3	PC-4	PC-5	PC-6	PC-7	PC-8
GEO450	Geological foundations for the development of oil and gas fields															x	x	x	x		x	x
GEO 624	Methods for laboratory study of organic matter, oil and gas															x	x		x	x		x
GEO 609	Innovative exploration methods														x		x	x		x		
GEO 604	Microscopic studies of minerals and rocks																x					x
GEO 625	Petrography of sedimentary rocks of oil and gas bearing regions of Kazakhstan															x	x	x	x	x		

## 9 MINOR CONTINUING EDUCATION POLICY

When developing at least 30 credits in the disciplines of the Mining Engineering program, including the following compulsory disciplines:

- M1 –Mining Basics - 5 credits
- M2 – Construction of a mining enterprise - 5 credits
- M3 –Mining technology - 5 credits
- M4 - Rock Destruction by Explosion - 5 credits
- M5 - Open pit mining technology
- M6 - Tunnel construction technology

Minor specialty “Mining Engineering” is assigned with the issuance of the diploma supplement in the established form.

When developing at least 30 credits in the disciplines of the program "Geotechnology for the development of uranium deposits", including the following compulsory disciplines:

- M1 - Technology of underground downhole leaching of ores - 5 credits
- M2 - Mineralogy of Uranium Ores – 5 credits
- M3 - Computer applications in uranium production (Atomgeo, ArcGIS, Surpac) - 5 credits
- M4 - Geochemistry of radioactive elements - 5 credits
- M5 - Geology and Genesis of Uranium Deposits - 5 credits
- M6 - Uranium Technology Basics - 5 credits
- M7 - Datamine / Micromine - 5 credits
- M8 - Feasibility study for uranium deposits development projects - 5 credits
- M9 - Basin Analysis and Sedimentary Geology - 5 credits

An additional Minor specialty “Geotechnology for the development of uranium deposits” is assigned with the issuance of an appendix to the diploma of the established sample.

## 10 ECTS DIPLOMA SUPPLEMENT

The application is developed according to the standards of the European Commission, Council of Europe and UNESCO / CEPES. This document is for academic recognition only and is not an official confirmation of an educational certificate. Without a diploma of higher education is not valid. The purpose of filling out the European Annex is to provide sufficient information about the holder of the diploma, the qualifications obtained by him, 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, which will be used to transfer estimates, uses the European system of transfers or credit transfer (ECTS).

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

**Bachelor of Engineering and Technology:**

Level 4 - Geologist-technician-surveyor, geologist-technician-search engine, geologist-technician-pro prospector, geologist-technician-cartographer, geochemist-technician, technician-geoecologist, technician-hydrogeologist, technician of engineering geology


Level 5 - Geologist-specialist-surveyor, geologist-specialist-search engine, geologist-specialist-pro prospector, geologist-specialist-cartographer, geochemist-specialist, geoecologist-specialist, hydrogeologist-specialist, mineralogist-specialist, petrographic specialist, specialist in engineering geology, lithologist-specialist sedimentologist, paleontologist specialist

Level 6 - Geologist-engineer-surveyor, geologist-engineer-search engine, geologist-engineer-pro prospector, geologist-engineer-cartographer, geochemist-engineer, geoecologist-engineer, geologist-engineer-hydrogeologist, mineralogist-engineer, petrographic engineer, engineer of engineering geology, lithologist, sedimentologist engineer, paleontologist engineer, senior surveyor geologist, senior search geologist, senior geologist-cartographer, senior geochemist, senior geoecologist, senior hydrogeologist, senior mineralogist, senior petrograph, Senior Engineering Geologist, Senior Litho log sedimentologist, senior paleontologist

Level 7 - Chief surveyor geologist, chief search geologist, chief survey geologist, chief cartographer, chief geochemist, chief geoecologist, chief geologist, chief hydrogeologist, chief mineralogist, chief petrograph, chief engineering geologist, chief sedimentologist, lithologist, chief paleontologist

Level 8 - President of the enterprise, general manager.

**Typical Diploma Supplement Form  
of the European system of transfer and accumulation of points**

 <b>ҚАЗ ҰТЗУ</b>	<b>Kazakh National Research Technical University named after K.I. Satpayev</b> <b>Қ.И.Сәтбаев атындағы Қазақ Ұлттық техникалық университеті</b>
<b>DIPLOMA SUPPLEMENT</b> # _____	
<p><i>This Diploma Supplement follows the model developed by the European Commission, the Council of Europe and UNESCO/CEPES. The purpose of this supplement is to provide sufficient independent data to improve the international 'transparency' and fair academic and professional recognition of qualifications (diplomas, degrees, certificates, etc.) It is designed to provide a description of the nature, level, context, content and status of the studies that were pursued and successfully completed by the individual named on the original qualification to which this supplement is appended. It should be free of any value - judgments, equivalence statements or suggestions about recognition. Information should be provided in all eight sections. Where information is not provided, a reason should be given.</i></p>	
<b>1</b>	<b>INFORMATION IDENTIFYING THE HOLDER OF THE QUALIFICATION</b>
1.1	Family Name
1.2	Given Name
1.3	Date of Birth (Day/Month/Year) <span style="float: right;">Republic Region, city (place of birth)</span>
1.4	Student Identification Number
<b>2.</b>	<b>INFORMATION IDENTIFYING QUALIFICATION</b>
2.1	Title of Qualification and the Title Conferred <span style="float: right;">Bachelor in Technics</span>
2.2	Major
2.3	Minor
2.4	Name and Status of Awarding University in original language <span style="float: right;">Қ.И.Сәтбаев атындағы Қазақ Ұлттық техникалық зерттеу университеті</span>
2.5	Name and Status of Awarding University in English <span style="float: right;">Kazakh National Research Technical University named after K.I. Satpayev</span>
2.6	Language of Instruction
<b>3</b>	<b>INFORMATION ON THE LEVEL OF THE QUALIFICATION</b>
3.1	Level of Qualification <span style="float: right;">Bachelor's level/ first-cycle degree of higher education</span>
3.2	Official Length of Program <span style="float: right;">4 or 3 years</span>

**Foreign language**

CODE - LNG108

CREDIT - 10 (0/0/6/6)

PREREQUISITE - diagnostic test

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LNG108

**PURPOSE AND OBJECTIVES OF THE COURSE**

Discipline in English “ Beginner English ” is intended primarily for learning from scratch. This course is also suitable for those who have only general basic knowledge of the language. After passing this level, the student will be able to confidently communicate on basic topics in English, learn the basics of grammar and lay a certain foundation that will allow him to improve his skills at the next stage of learning English.

Course postrequisites : Elementary English .

Discipline “ Elementary English ” is the foundation of learning English, which is aimed at developing students' receptive skills (reading and listening) and productive skills (writing and speaking), analyzing basic knowledge, using and memorizing the main grammar rules and mastering the features of pronunciation and elementary vocabulary, as well as encouraging independent learning and critical thinking.

Course Prerequisites : Beginner .

Course postrequisites : General 1.

The aim of the course “ General English 1 ” - to provide students with the opportunity to gain sufficient knowledge to become more fluent in everyday social and academic conditions. Students work on improving pronunciation, expanding vocabulary and grammar. At this level, the main task will be to consolidate the skills acquired earlier, learn how to compose and correctly apply complex syntactic constructions in English, and also achieve really good pronunciation.

Course Prerequisites : Elementary English .

Course postrequisites : General 2.

Course “ General ” English 2” is designed for students who continue to study “ General English 1”. The course is focused on the ability to actively use in practice most aspects of the tenses of the English language, conditional sentences, phrases in the passive voice, etc. At this stage, the student will be able to maintain a conversation with several interlocutors or express their point of view. The student significantly expands his vocabulary, which will allow him to freely express his thoughts in any environment. At the same time, speech will be replenished with various synonyms and antonyms of already familiar words, phrasal verbs and set expressions.

Course prerequisites : General 1.

Course postrequisites : Academic English .

The main goal of the English language course “ Academic English ” is the development of academic language skills. The discipline is a language style that is used when writing academic papers (paragraph, abstract, essay, presentation, etc.). This course is designed to help students become more successful and effective in their learning, developing critical thinking and independent learning skills.

Course prerequisites : General 2.

Course postrequisites : Professional English .

“ Business English ” (Business English) is the English language for business communication, business and career. Knowledge of business English will be useful for negotiating and business correspondence, preparing presentations and informal communication with business partners.

The peculiarities of the preparation are that it is necessary not only to master the vocabulary, but also to master new skills: presentation, communication, language, professional.

Prerequisites Course : IELTS score 5.0 and / or Academic English

Postrequisites course : Professional English, IELTS score 5.5-6.0

“ Professional English ” course is designed for B2+ level students, the purpose of which is to improve the language competence of students in their respective professional fields. The main goal of the course is to teach students to work with texts, both audio and written, in their specialty. The curriculum is built on the necessary vocabulary (words and terms) often used in English for specific purposes. Students will acquire professional English language skills through content and language-based integrated learning, acquire the vocabulary to read and understand original sources with a great degree of independence, and practice different communication patterns and vocabulary in specific professional situations.

Course Prerequisites : Business English .

Course postrequisites : any elective course.

**Kazakh/Russian language**

CODE - LNG104

CREDIT - 10 (0/0/6/6)

PREREQUISITE - diagnostic test

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**PURPOSE AND OBJECTIVES OF THE COURSE**

- to teach students to perceive by ear statements on well-known topics related to home, study, free time;
- understand texts on personal and professional topics containing the most frequent words and expressions;
- be able to carry on a conversation on everyday topics; describe your experiences; tell your opinion; retell and evaluate the content of a book read, a film seen;
- be able to create simple texts on well-known topics, including those related to professional activities.

**BRIEF DESCRIPTION OF THE COURSE**

The language material of the course is selected in such a way that the student, learning the lexical and grammatical minimum, has the opportunity to get acquainted with typical communicative situations and find himself in such situations, be able to correctly assess them and choose the appropriate model (strategy) of speech behavior.

In this case, the main emphasis of learning is transferred from the process of transferring knowledge to learning the ability to use the target language in the course of various types of speech activity, which are reading (subject to reading comprehension), listening (under the same condition) and the production of texts of a certain complexity with a certain degree of grammatical and lexical correctness.

The material for the classes is selected so that students, studying the Kazakh / Russian language, acquire the skills of reading, writing and understanding sounding speech based on the simultaneous development of the basics of grammar (phonetics, morphology and syntax) and word usage in the course of constant repeated repetition with a gradual complication of tasks.

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

The student, subject to the active organization of work in the classroom and conscientious completion of homework, by the end of the first semester, acquires the skills corresponding to the pan-European level A 2 ( Threshold according to the ALTE classification), that is, he is on the threshold of the level of independent language proficiency.

**Physical Culture**

CODE - KFK 101-104

CREDIT - 8 (0/0/8/0)

PRE-REQUISITE - no

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**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of mastering the discipline "Physical culture" is the formation of a person's physical culture, the presence of which ensures readiness for social and professional activities, inclusion in a healthy lifestyle, systematic physical self-improvement.

**BRIEF DESCRIPTION OF THE COURSE**

Theoretical foundations of physical culture. Physical culture in the general cultural and professional training of students. Methodological and practical section. Socio-biological foundations of physical culture. Fundamentals of a healthy lifestyle for students. Physical culture in ensuring health. General physical and special training in the system of physical education. Fundamentals of methods of self-study Physical exercises and self-control involved in physical exercises and sports.

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

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

Know : the influence of health-improving systems of physical education on health promotion, prevention of occupational diseases and bad habits;

- ways of monitoring and evaluating physical development and physical fitness;
- rules and methods of planning individual lessons of various target orientation.

Be able to : overcome artificial and natural obstacles using a variety of modes of movement;

- to carry out creative cooperation in collective forms of physical culture lessons;
- organize the daily routine in accordance with the criteria of a healthy lifestyle;
- explain the importance of volitional qualities, emotions in the formation of psychophysical qualities.

Have skills : application of means of physical culture to increase resistance to various environmental conditions;

- organization and conduct of individual, collective and family recreation and participation in mass sports competitions.





**Information and Communication Technologies (in English ) yaz )**

CODE - CSE 174

CREDIT - 5 (2/1/0/2)

PRE-REQUISITE - no

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**PURPOSE AND OBJECTIVES OF THE COURSE**

- Training in the skills of applying modern information technologies in the field of professional activity. Course objectives include:
- To reveal the basic concepts of architecture of computer systems;
- To reveal the basic concepts of information and communication technologies and subject terminology;
- To teach how to work with software interfaces of operating systems;
- To teach how to work with data in various representations, both in tabular structured and unstructured form;
- Teach how to apply the basic principles of information security;
- Expand the concepts of data formats and multimedia content. Learn how to work with typical multimedia data processing applications. Use modern approaches to the presentation of material;
- To reveal the concepts of modern social, cloud and email platforms and how to work with them;
- To teach how to use algorithmization and programming methods to solve business process automation problems

**BRIEF DESCRIPTION OF THE COURSE**

The course contains a training program aimed at leveling the basic knowledge of students in the field of information and communication technologies. It contains a full range of topics, according to the SCES Standard Curriculum, with a predominance of developing practical skills in working with data, algorithmization and programming. The course is structured in such a way as to teach students not only the basic concepts of architecture and modern infrastructure of information and communication technologies, but also teach how to use these tools to solve applied problems. To teach how to optimize processes, apply adequate models and methods for solving practical problems using modern methods and tools of information technology, automate routine processes, be productive and efficient.

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

Students will know:

- Computer device;
- Computer systems architecture;
- Infrastructure of information and communication technologies;
- Interfaces of modern operating systems;

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- Modern tools for working with data of various nature and purpose;
- Types of threats to information security, principles, tools and methods of data protection;
- Python Programming Language .

Students will be able to:

- Work with the interfaces of modern operating systems;
- Work with modern application software for working with data of various nature and purpose;
- Apply modern social, cloud, email platforms to organize business processes;
- Program in an algorithmic programming language;
- Analyze, model, design, implement, test and evaluate information and communication technology systems

**Modern history of Kazakhstan**

CODE - HUM100

CREDIT - 5 (1/0/2/2)

PRE-REQUISITE - no

**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course is to familiarize students of technical specialties with the main theoretical and practical achievements of domestic historical science on the problems of the history of modern Kazakhstan, a comprehensive and systematic study of the main stages of the formation and development of Kazakhstani society.

- analyze the features and contradictions of the history of Kazakhstan in the Soviet period;
- to reveal the historical content of the foundations of the laws of political, socio-economic, cultural processes at the stages of the formation of an independent state;
- contribute to the formation of the civic position of students;
- to educate students in the spirit of patriotism and tolerance, belonging to their people, the Fatherland.

**BRIEF DESCRIPTION OF THE COURSE**

The course Modern history of Kazakhstan is an independent discipline and covers the period from the beginning of the twentieth century to the present day. The modern history of Kazakhstan studies the national liberation movement of the Kazakh intelligentsia at the beginning of the 20th century, the period of the creation of the Kazakh ASSR, as well as the process of the formation of a multinational society.

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

- knowledge of events, facts and phenomena of the modern history of Kazakhstan;
- knowledge of the history of ethnic groups inhabiting Kazakhstan;
- knowledge of the main stages of the formation of the Kazakh statehood;
- the ability to analyze complex historical events and predict their further development;
- ability to work with all types of historical sources;
- the ability to write essays and scientific articles on the history of the Fatherland;
- ability to operate with historical concepts;
- the ability to lead a discussion;
- skills of independent analysis of historical facts, events and phenomena;
- public speaking skills.

**Philosophy**

CODE - HUM 132

CREDIT - 5 (1/0/2/2)

PRE-REQUISITE - no

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**PURPOSE AND OBJECTIVES OF THE COURSE**

Formation of students' social and personal competencies based on a humanistic worldview and modern philosophical culture, development of students' creative thinking, understanding of the philosophical foundations of research activities in the field of science and technology.

This goal is achieved as a result of solving the following tasks: 1) mastering philosophical terminology; 2) understanding the structure of philosophical knowledge and its problems; 3) development of the wealth of the historical and philosophical heritage; 4) study of modern trends in the development of philosophy; 5) application of philosophical knowledge to solving problems in various areas of social and professional activity, etc.

**BRIEF DESCRIPTION OF THE COURSE**

Philosophy forms and develops critical and creative thinking, worldview and culture, provides knowledge about the most general and fundamental problems of being and endows them with a methodology for solving various theoretical practical issues. Philosophy expands the horizon of vision of the modern world, forms citizenship and patriotism, contributes to the education of self-esteem, awareness of the value of human existence. It teaches how to think and act correctly, develops the skills of practical and cognitive activity, helps to seek and find ways and means of life in harmony with oneself, society, and the world around.

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

Seminars are designed to contribute to the solution of the general tasks of the course "Philosophy" and the formation of basic philosophical competencies: knowledge of the problems, ideas and personalities of world and domestic philosophy, the content of the main sections of philosophical knowledge; the ability to think critically, to defend one's convictions with reason; application of philosophical knowledge in the analysis of socio-cultural and professional problems and situations; determining the social and humanistic significance of their professional and social activities .

**Module of socio-political knowledge (sociology, political science )**

CODE - HUM 120

CREDIT - 3 (1/0/0/1)

PRE-REQUISITE - no

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**PURPOSE AND OBJECTIVES OF THE COURSE**

The objectives of mastering the discipline "Political Science" are: the formation of a system of knowledge about the formation and development of political science; demonstration of the great importance of political science in the modern world; formation of citizenship.

The tasks of political science are the formation of knowledge about politics, political activity; explanation and prediction of political processes and phenomena, political development; development of the conceptual apparatus of political science, methodology and methods of political research.

**BRIEF DESCRIPTION OF THE COURSE**

The process of studying the discipline is aimed at the formation of the following competencies: knowledge of the characteristics of various political systems and the functions of political institutions; orientation in the most important political processes taking place in the world and the country; the ability to apply political science knowledge in professional activities.

The science of society, its constituent systems and patterns of its functioning and development, social institutions, relationships, communities and groups. Sociology studies society, revealing the internal mechanisms of its structure and the development of its structures (structural elements: social communities, institutions, organizations and groups); laws of social actions and mass behavior of people, as well as the relationship between the individual and society.

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

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

Know:

- basic theories of political science; principles of formation and functioning of the political system of society, the main laws of its development;
- the benefits of a democratic society;
- - the main stages of the socio-cultural development of society and the factors of social development;
- - essence and forms of social interactions and relations;
- - the specifics of interpersonal relations in groups; features of formal and informal relations; the nature of leadership and functional responsibility;
- - mechanisms for the emergence and resolution of social conflicts, regulation of the relationship of social communities, groups and ethnic groups.

Be able to:

- understand the features of the state structure and the main types of political and party systems;
- freely navigate the political ideologies of the modern world;
- competently form their civic position;

Own:

- key concepts and methods to analyze publications on political topics.
- methods of sociological analysis and forecast of social (public) situations; sufficient argumentation to explain and confirm various sociological situations.

**Module of socio-political knowledge (culturology, psychology )**

CODE - HUM 134

CREDIT - 5 (1/0/0/1)

PRE-REQUISITE - no

**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of mastering the discipline "Culturology" is the formation of ideas about culture as a social phenomenon and a philosophical category, overcoming a simplified stereotypical attitude to the diversity of cultural phenomena and processes. The subject of psychology is the study of the human psyche. However, the psyche is inherent not only in humans, it is also found in animals.

The main task of psychology as a science is to study the features of the formation, development and manifestation of mental phenomena and processes.

**BRIEF DESCRIPTION OF THE COURSE**

The discipline "Culturology" is designed to acquaint students with the cultural achievements of mankind, to understand and assimilate the basic forms and universal patterns of formation and development of culture, to develop their desire and skills to independently comprehend the entire wealth of world culture values for self-improvement and professional growth. The course of culturology deals with general problems of the theory of culture, leading culturological concepts, universal patterns and mechanisms for the formation and development of culture, the main historical stages in the formation and development of Kazakhstani culture, its most important achievements.

The object of psychology is the laws of the psyche as a special form of human life and animal behavior. This form of life activity, due to its versatility, can be studied in a wide variety of aspects, which are being studied by various branches of psychological science.

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline "Culturology", students should know:

- basic theories of culture;
- structure and morphology of culture;
- methods of studying cultural forms, processes and practices of culture,
- typology of culture;
- forms and practices of different cultures;

2. must be able to:

- logical presentation of mastered knowledge;
- demonstrate an understanding of systemic relationships within the discipline;



- critically use the main methods of modern science in the teaching and research text;
- analyze scientific literary or visual text;
- bring their own independent examples to the scientific provisions of the course;
- ensure intercultural dialogue in society.

## **Fundamentals of anti-corruption culture**

CODE - HUM 133

CREDIT - 5 (1/0/1/1)

PRE-REQUISITE - no

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### **PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the discipline is to gain practical skills in entrepreneurial activities, to get acquainted with theories and types of leadership, and to understand the foundations of an anti-corruption culture.

### **BRIEF DESCRIPTION OF THE COURSE**

Students will study the theory and practice of entrepreneurship as a system of economic, organizational and legal relations of business structures . They will develop their leadership and teamwork skills. They will also study the causes of corruption and methods to combat it.

### **KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, the student:

1. must know:
  - issues of discipline to the extent necessary to solve professional problems;
  - the mechanism of entrepreneurship, taking into account the accumulated experience in the development of theory and practice;
  - application of civil legislation regulating the organization of entrepreneurial activity;
  - basic concepts and terms.
2. must be able to:
  - choose the organizational and legal form of the enterprise based on the goals of the enterprise and the characteristics of the organization and functioning of enterprises in various forms;
  - evaluate the effectiveness of entrepreneurial activity;
  - evaluate external and internal risks for the enterprise;
  - develop business plans taking into account regulatory, resource, administrative and other conditions.
3. must own:
  - methods of planning activities and evaluating the effectiveness of entrepreneurial activities, methods of assessing the value of a business;
  - methods of protecting entrepreneurs from attacks on their assets

**Fundamentals of Entrepreneurship and Leadership**

CODE - MNG 488

CREDIT - 5 (1/0/0/1)

PRE-REQUISITE - no

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**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the discipline is to form students' ability to recognize and evaluate the negative factors of the human environment, to determine the consequences for a person of harmful and damaging factors, to implement reliable methods of protection against them, to choose the optimal solution and correct behavior, safety and preservation of life in emergency situations of natural, man-made and social character. The tasks of mastering the academic discipline: acquiring an understanding of the problems of sustainable development, ensuring life safety and reducing the risks associated with human activities; formation of a culture of professional safety, the ability to identify hazards and assess risks in the field of their professional activities

**BRIEF DESCRIPTION OF THE COURSE**

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

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

- main technosphere hazards, their properties and characteristics,
- the nature of the impact of hazardous and harmful factors on humans and nature, methods of protection against them;
- the specifics and mechanism of the toxic effects of harmful substances, energy effects and the combined action of factors;
- technical and organizational bases for ensuring the safety of production processes, sustainability of production in emergency situations;
- theoretical foundations for ensuring life safety; the current system of regulatory legal acts in the field of technosphere safety;
- security management system;

be able to:

- identify the main hazards of the human environment, assess the risk of their implementation, choose methods of protection against hazards and ways to ensure comfortable living conditions;
- use basic means of environmental quality control;
- apply methods for analyzing the impact on humans and their activities with the environment;

own:

- legislative and legal acts in the field of safety and environmental protection, safety requirements of technical regulations;
- ways and technologies of protection in emergency situations;

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- conceptual and terminological apparatus in the field of security; methods of ensuring the safety of the environment.

**Ecology and life safety**

CODE - SNE656

CREDIT - 2 (1/0/0/1)

PRE-REQUISITE - no

**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of studying the discipline is to study by students the global environmental problems of the 21st century, the prerequisites, ideas and ways of transition to sustainable development in world practice. The discipline allows to form knowledge about the concept of sustainable development and the main ways of transition to it at the global, regional and local levels.

Tasks:

- understand the causes of the emergence and development of global environmental problems;
- master the basic terms and definitions of the theory of sustainable development;
- acquire practical skills in the development and implementation of long-term sustainable development programs.
- master a systematic approach to solving environmental problems in the context of global problems of social development;
- to form in students a holistic worldview and active citizenship for a clearer understanding of the role and mission of environmental specialists in solving modern problems of environmental protection and rational nature management

**BRIEF DESCRIPTION OF THE COURSE**

The discipline studies global environmental problems and the relationship with general development problems; the consequences of population growth and consumption of natural resources; conditions for sustainable existence on Earth; the mission of ecologists in solving contemporary environmental problems; environmental consequences of natural resource depletion and environmental pollution.

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

Know:

- fundamentals of the concept of sustainable development as a strategy for the global development of mankind;
- the history of the emergence of the concept of sustainable development and the formation of its modern concept;

Understand:

- methodology for constructing and calculating the system of indicators of sustainable development;

Be able to: characterize the natural and anthropogenic factors of the emergence of instability in the biosphere, the consequences of human influence on the biosphere.

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**Mathematics I**

CODE - MAT101

CREDIT - 5 (1/0/2/2)

PRE-REQUISITE - no

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**PURPOSE AND OBJECTIVES OF THE COURSE**

The main goal of the course is to give the future specialist a certain amount of knowledge in the sections of the course "Mathematics-I", necessary for the study of related engineering disciplines. Introduce students to the ideas and concepts of calculus. The main attention should be paid to the formation of basic knowledge and skills with a high degree of their understanding of differential and integral calculus .

Course objectives :

acquisition of knowledge necessary for the effective use of rapidly developing mathematical methods ; obtaining the skill of building and researching mathematical models; possession of the fundamental sections of mathematics necessary for solving research and practical problems in the professional field.

**BRIEF DESCRIPTION OF THE COURSE**

The course "Mathematics- I " provides an exposition sections: introduction to analysis, differential and integral calculus

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

The study this discipline will allow student apply the course "Mathematics- I " to solving simple practical problems, find tools sufficient for their study, and obtain numerical results in some standard situations.

**Mathematics II**

CODE - MAT102

CREDIT - 5 (1/0/2/2)

PREREQUISITE - Mathematics 1

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**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of teaching the course " Mathematics II" is to form in bachelors ideas about modern mathematics as a whole as a logically coherent system of theoretical knowledge.

The objectives of the course **are to** instill in students solid skills in solving mathematical problems with bringing the solution to a practically acceptable result. To develop the primary skills of mathematical research of applied issues and the ability to independently understand the mathematical apparatus contained in the literature related to the student's specialty.

**BRIEF DESCRIPTION OF THE COURSE**

The course "Mathematics- II " provides an accessible presentation of the sections: elements of linear algebra and analytic geometry, differential calculus of functions of many variables, multiple integrals. "Mathematics II" is a logical continuation of the course "Mathematics I".

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

The study of this discipline will allow you to put into practice the acquired theoretical knowledge and skills with a high degree of understanding of the sections of the course, use them at the appropriate level; translate into mathematical language the simplest problems posed in terms of other subject areas; acquire new mathematical knowledge using educational and information technologies; solve applied problems in the field of professional activity

**Physics**

CODE - PHY 468

CREDIT - 5 (2/2/0/1)

PRE-REQUISITE - no

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**PURPOSE AND OBJECTIVES OF THE COURSE**

the main goal of teaching the course is to form ideas about the modern physical picture of the world and the scientific worldview.

**BRIEF DESCRIPTION OF THE COURSE**

The disciplines Physics I and Physics II are the basis for theoretical training and for engineering and technical activities of graduates of a higher technical school and represent the core of the physical knowledge necessary for an engineer operating in the world of physical laws. The course "Physics 1" includes sections: the physical foundations of mechanics, the structure of matter and thermodynamics, electrostatics and electrodynamics. The discipline "Physics II " is a logical continuation of the study of the discipline "Physics 1", and forms a holistic view of the course of general physics as one of the basic components of the general theoretical training of bachelors of engineering and technical profile. The discipline "Physics II" includes sections: magnetism, o optics , nanostructures , fundamentals of quantum physics, atomic and nuclear physics.

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

– the ability to use knowledge of fundamental laws, theories of classical and modern physics, as well as the use of physical research methods as the basis of a professional activity system.



**Engineering and computer graphics**

CODE - GEN 429

CREDIT - 5 (1/2/0/2)

PRE-REQUISITE - no

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**PURPOSE AND OBJECTIVES OF THE COURSE**

Acquisition of skills in working with graphic design systems, acquisition of skills in the field of creating and reading graphic documentation, allowing you to study other graphic systems and necessary in subsequent engineering activities.

**BRIEF DESCRIPTION OF THE COURSE**

The course develops the following skills for students: depict all possible combinations of geometric shapes on a plane, conduct research and measure them, allowing image transformations; create technical drawings, which are the main and reliable means of information that provide communication between the designer and the designer, technologist, builder. Introduces students to the basics of automated preparation of the graphic part of design documents in the AutoCAD environment .

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

A student who has successfully completed the course must: 1. Have an understanding of graphic systems, machine representation and object creation. 2. Orientate in the field of computer modeling and design of flat and volumetric models.

**General geology**

CODE - GEO194

CREDIT - 4 (2/1/0/1)

PRE-REQUISITE - no

**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course: development of students' geological outlook; creation of a basis for further obtaining special knowledge, skills and abilities in the process of studying all subsequent geological disciplines.

Course objective: obtaining general ideas about the structure of the Universe, the internal structure of the Earth, the geological activity of the main factors of its external and internal dynamics, the form of occurrence of geological bodies, tectonic movements and methods for their study, the main structures of the earth's crust.

**BRIEF DESCRIPTION OF THE COURSE**

The course "General Geology" considers the geological structure of the earth's crust; material (chemical, mineral and petrographic) composition of the earth's crust; the main structural elements of the earth's crust with their characteristic rock complexes; the main results of the most important endogenous and exogenous geological processes and their role in the formation of the earth's crust; forms of occurrence of geological bodies in the earth's crust, types of tectonic disturbances; methods of their representation on geological maps and sections, the concept of a geochronological (stratigraphic) scale.

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students must

- 1) know: the internal structure of the Earth,
    - geological activity of the main factors of its external and internal dynamics,
    - forms of occurrence of geological bodies, tectonic movements and methods for their study, types of structures of the tecton and lithosphere .
  - 2) be able to:
    - independently determine the most common minerals and rocks and explain their genesis;
    - recognize simple tectonic structures, geological bodies and landforms;
  3. own skills:
    - work with a mountain compass;
    - construction of geological maps of a simple structure and geological sections;
- reading simple geological maps.

**Structural geology**

CODE - GEO432

CREDIT - 5 (2/1/0/2)

PREREQUISITE – GEO194 General Geology

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**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course: structural geology studies the various forms of rock occurrence, their location and relationships, the conditions of formation in the earth's crust. The completion of the study of the discipline is a term paper. It aims to consolidate skills in reading geological maps. Based on an in-depth analysis of the geological tablet, an explanatory note is drawn up, illustrated with graphic applications (maps, sections). Completed term papers, after checking by their supervisor, are protected by performers and are accepted with a differentiated assessment.

Course objective:

- study of the form of occurrence of rocks in the earth's crust;
- methods for compiling and reading geological, tectonic and structural maps,
- construction of geological sections and block diagrams, stratigraphic columns

**BRIEF DESCRIPTION OF THE COURSE**

The course "Structural Geology" studies the forms of geological bodies, undisturbed horizontal layers, deformations of rock layers, formation of layers under the influence of endogenous, exogenous and space factors; main elements of folds, typification of folds, folded forms of high ranks ( anteklises , syneclises , etc.); main elements of discontinuous dislocations, their typification; kinematic types of faults (faults, reverse faults, shifts, etc. ); features of the manifestation of deformations on platforms, in folded belts, rifts and other global tectonic structures

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students must

1) know:

- the forms of occurrence of geological bodies in the earth's crust and the patterns of their placement and combination, as well as the geological conditions of formation;
- methods for compiling and reading geological, tectonic and structural maps, geological sections and block diagrams, stratigraphic columns;
- about the close connection between the study of the structural forms of geological bodies with the practice of geological exploration and with theoretical geology.

2) be able to:

- determine the elements of occurrence of rock layers using a mountain compass (strike azimuth, dip angle, etc.);
- according to well drilling data, using structural maps; display folded forms and discontinuous dislocations on geological maps and sections;

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- use general and special computer programs for processing structural and geological information;
- read geological maps, build geological sections, stratigraphic columns,
- correctly describe the geological structure of the area according to the geological map in accordance with the scheme of the production report.

3) master the skills:

- studying the morphometry of structural forms,
- development of their classification in connection with the regular distribution and combination in the earth's crust to depth and area;
- analysis of the geological, tectonic structure of the area and understanding of the history of the geological development of the area.

## **Crystallography and mineralogy**

CODE - GEO196

CREDIT - 6 (2/1/0/2)

PREREQUISITE – GEO194 General Geology

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### **PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course: Students gain knowledge on the basic theoretical and applied issues of crystallography and mineralogy, which is a fundamental geological discipline that underlies the study of rocks, ore and non-metallic minerals, processes occurring in the earth's crust, as well as in cosmic bodies

Course objective:

- mastering the fundamentals of crystallography, which is closely connected with industry, the development of which requires specialists to have in-depth knowledge in the field of crystallography;
- the acquisition of skills in determining the elements of symmetry in crystalline polyhedra, in recognizing simple shapes that are found in nature;
- possession of methods of visual diagnostics of common minerals;
- obtaining knowledge on the diagnosis of minerals by morphological features;
- the ability to use paragenetic associations of minerals for the diagnosis of minerals;
- obtaining knowledge on the conditions for the formation of the main minerals.

### **BRIEF DESCRIPTION OF THE COURSE**

The course "Crystallography and Mineralogy" studies the basic concepts and laws of crystallography; classification of crystals based on their symmetry; geometric crystallography, which studies the external and internal structure of crystals; crystal chemistry or structural chemistry; crystal physics. Understands the influence of the structure on the external shape and physical properties of crystals, the main motives for constructing structures - frame, sheet, tape, chain, with isolated groups of atoms; conditions of origin and location of minerals in nature; the main groups of minerals, their composition, physical properties and practical application, the processes of mineral formation and their corresponding mineral paragenesis; the basic laws of the crystal structure, external forms, chemical composition, physical properties and conditions for the formation of crystals in the relationship.

### **KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students must

1) know:

- the history of crystallography and mineralogy as a science, the relationship with other exact and natural sciences, the main modern problems and development prospects, the basic laws of crystallography;

- the state of aggregation of a mineral as a solid body, the concept of a crystal and a crystalline substance, their basic properties;
  - symmetry and classification of crystals;
  - common simple forms of crystals, their parameters and indices, combinations of simple forms;
  - fundamentals of the theory of crystal growth, factors affecting the growth of crystals, shapes of real crystals;
  - general theoretical representations of the foundations of mineralogy, the definition of a mineral and its chemical composition, physical properties 4
  - geological processes of mineral formation , basic terms and definitions;
  - principles of classification of minerals.
- 2) be able to:
- identify the natural crystal of the mineral, its genetic affiliation;
  - apply the methods of visual diagnostics of the mineral, determine the common ore and rock-forming minerals in the samples;
  - to analyze the paragenetic association of the mineral and to reconstruct the chemistry of the medium of mineral formation .
- 3) master the skills:
- methods for determining the symmetry of crystals, their crystallographic classification, parameters and indices of simple shapes;
  - methods of visual diagnostics of minerals, analysis of paragenetic associations;
  - methods of diagnostics of minerals, including the determination of their crystal-morphological, physical properties, analysis of mineral associations and the chemistry of the medium of mineral formation .

**Petrography**

CODE - GEO434

CREDIT - 5 (1/2/0/2)

PREREQUISITE – GE0196 Crystallography and mineralogy

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**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course: a comprehensive knowledge of the composition, structure, structure and texture, classification of igneous, sedimentary, metamorphic, metasomatic rocks, nomenclature and conditions for the formation of rocks and the relationship of mineral deposits with them.

Course objective:

- Study of igneous rocks: formation, material composition and structure. Structures and textures of igneous rocks.
- Study of sedimentary rocks: formation, material composition, structure. Textures and structures of sedimentary rocks. Classification of sedimentary rocks.
- Study of metamorphic rocks: factors and types of metamorphism, material composition, structure. Textures and structures of metamorphic rocks. Types of metamorphism: cataclastic, contact-thermal, regional, metasomatism.

**BRIEF DESCRIPTION OF THE COURSE**

The course "Petrography" studies the composition, structure, conditions of occurrence, classification and patterns of formation of igneous, sedimentary, metamorphic and metasomatic rocks that meet the current level of science and the requirements of geological practice. Understands the relationship of petrography with other geological disciplines and its importance for geological surveying, prospecting and exploration of mineral deposits; applies methods of studying rocks; main problems and tasks of petrography.

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students must

- 1) know:
  - the structure of the Earth, the history of the geological development of the planet,
  - main geological processes, basics of petrography
  - the most important types of rocks of igneous, sedimentary and metamorphic genesis,
  - their systematics
  - assessment of the formation conditions,
  - diagnostic methods
- 2) be able to:
  - explain the origin of the most common minerals and rocks, landforms, elementary geological structures;

- use petrographic information to reconstruct rock formation processes
- 3) master the skills:
- skills in identifying types of rocks and minerals
  - determine the main types of rocks by external signs, describe the composition, structure and texture of rocks.



## **Sedimentology**

THE CODE - GEO439

CREDIT - 5 (2/1/0/2)

PREREQUISITE - GE0431      General and Historical Geology

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### **PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course: to give students the basic knowledge of sedimentology as a science dealing with the study of sediment, its composition, structure, composition, origin, distribution and evolution.

Course objective: When studying the discipline, specialists must learn the methodology of studying sediments and sedimentary rocks, understand the basics of facies analysis, methods of paleogeographic research.

### **BRIEF DESCRIPTION OF THE COURSE**

The course " Sedimentology " gives an idea of the subject of science, goals, objectives, place among other geological sciences. The discipline provides information about sediments, their elemental, chemical, mineral and component composition. The issues of sediment mobilization, transportation, differentiation and accumulation are considered. Textural and structural features, facies settings, and conditions for the formation of sedimentary rocks are studied.

### **KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students must

1) know:

- history, problems, prospects and directions of development of science;
- signs of sediments and sedimentary rocks as products of the Earth's exosphere;
- methodology for studying precipitation and modern methods for their study;
- devices and technologies for field and laboratory, including crystal-optical diagnostics of sediment components;
- material composition of sediments, textural and structural features;
- basic properties of sedimentary formations, including their reservoir properties;
- features of the formation of sediments and sedimentary rocks;
- the influence of ancient and modern landscape and climatic conditions on the formation of sedimentary rocks;
- methods of paleogeographic research;
- basics of facies analysis;
- basic physical and mechanical properties of sediments and sedimentary rocks;

2) be able to:

- identify and describe the material and structural-textural features of sediments and sedimentary rocks;
- classify and diagnose sedimentary rocks of various genesis;

- to use the crystal-optical method of studying sedimentary rocks as one of the leading methods;

3) master the skills:

- use of the granulometric method for studying sedimentary rocks for the nomenclature and genetic interpretation of the environments of their formation;

- analysis of landscape facies of sediment formation in the general genesis of rocks, using their structural and textural features and material composition.

## General chemistry

CODE - CHE495

CREDIT - 5 (1/1/1/2)

PRE-REQUISITE - no

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### PURPOSE AND OBJECTIVES OF THE COURSE

The purpose of the course: Formation of knowledge on the fundamental issues of general chemistry and the skills of their application in professional activities.

Course objective:

- transfer basic theoretical knowledge in the course of chemistry;
- help students gain laboratory skills;
- teach how to solve typical problems and paint reaction equations;
- which contributes to the informal assimilation of theoretical material;
- to form students' chemical thinking skills.

### BRIEF DESCRIPTION OF THE COURSE

The course "General Chemistry" considers the laws, theoretical provisions and conclusions that underlie all chemical disciplines, studies the properties and relationships of chemical elements based on the periodic law of D.I. Mendeleev and on modern ideas about the structure of matter, the basics of chemical thermodynamics and kinetics, processes in solutions, the structure of complex compounds.

### KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE

As a result of mastering the discipline, students must

1) know:

- basic chemical laws and concepts,
- various chemical systems
- basic laws of chemical reactions,
- the reactivity of substances based on knowledge of the structure of atoms, the periodic system of elements and chemical bonds.

2) be able to:

- solve problems using acquired knowledge,
- write reaction equations
- make calculations using the basic chemical laws.

3. own skills:

- navigate the basic concepts of chemistry, the properties of elements, non -metals and metals of groups of the periodic system;
- acquire the skills of compiling chemical equations, solving problems, explaining the properties of elements and their compounds based on the laws of chemistry, conducting chemical experiments and explaining the phenomena that occur.

**Geology and mineral resources of Kazakhstan**

CODE - GEO435

CREDIT - 5 (2/1/0/2)

PREREQUISITE – GEO432 Structural Geology

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**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course: The formation of students' holistic view of the geological structure and development of the earth's crust within the territory of Kazakhstan, familiarity with the main types of mineral resources, the provision of the country with them in the future and priorities in the mineral resource complex.

Course objective:

- study of the geological structure of the bowels of Kazakhstan;
- acquaintance with the basic principles of tectonic zoning of the territory of Kazakhstan;
- acquaintance with the main tectonic structures of the earth's crust, their stratigraphy and igneous complexes, features and patterns of geological development and the placement of mineral deposits in them.

the main task studying the discipline lies in the development of geological thinking among students of geologists, based on an extensive base of factual material with the ability to competently structure it and use it in accordance with the logic of fundamental conceptual geological paradigms.

study of the form of occurrence of rocks in the earth's crust;

**BRIEF DESCRIPTION OF THE COURSE**

An idea is given about the geological structure of the subsoil and the development of the earth's crust within the territory of Kazakhstan, about the mineral resources of Kazakhstan, their classification, reserves, priority and strategic types of raw materials. Tasks of the geological service of Kazakhstan at the present stage. The course contains information about the main types of mineral resources, the provision of the country with them in the future and priorities in the mineral resource complex.

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students must

- 1) know: about the features of the geological structure and the history of the development of the earth's crust on the territory of Kazakhstan, to know the main types of mineral resources of the republic, the degree of provision of the country with them at the present time and in the future. Know the principles of tectonic zoning of the territory of Kazakhstan, the main structural elements of the earth's crust of this territory, the main types of minerals and the general patterns of placement of their deposits within the republic.

- 2) be able to: analyze the geological structure of any part of the earth's crust, compose its integral characteristics and interpret the conditions for its development in time and space.
- 3) master the skills of: compiling geological sections and tectonic maps of various scales, reading and compiling schematic geological maps of various contents.

**Geodesy with the basics of topography**

CODE - MAR 113

CREDIT - 5 (2/0/1/2)

PREREQUISITE - Mathematics

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**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course: to familiarize students with science, who studies form and the dimensions of the Earth's surface or its individual sections by measurements, in the mathematical processing of measurements with the construction of maps, plans, used to solve engineering and other problems.

Course objective: is to train future specialists in the geological industry the basics of theoretical and practical knowledge in solving problems on topographic maps and plans; a complex of geodetic studies related to the implementation of topographic surveys for the preparation of large-scale plans ; angular and linear measurements by optical-mechanical and electronic geodetic instruments; in the mathematical processing of field measurements based on direct and inverse geodetic problems in accordance with the requirements of the instructions; determination of coordinates and elevations of points on the earth's surface in a single coordinate system; in the construction of the processed data on a plan or in a profile.

**BRIEF DESCRIPTION OF THE COURSE**

The course contains a training program that gives the basic concepts of the shape and size of the Earth, the coordinate systems used in geodesy, the orientation of lines on the ground, plans, maps, profiles, scale, terrain, angular and linear measurements, various planned - high-altitude shooting. The course is structured in such a way as to teach the student not only basic concepts, but also to teach how to perform field work of various vertical and vertical surveys, process field measurements of various horizontal and vertical surveys, build and draw up a plan or profile when solving engineering problems using equipment and technology, according to the requirements of the labor market.

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students must

1. *know* :

- about the shape and dimensions of the Earth and its individual parts of the surface, about how to depict them on a map, about the close connection of geodesy with all the technological processes of a mining enterprise;
- the device of the main geodetic instruments, the methodology for performing angular, linear and height measurements on the earth's surface, the rules for office processing of geodetic measurements, the basic requirements for compiling topographic documentation .

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2) *be able to* :

- to use topographic and geodetic material in solving practical problems of mining ;  
- perform the simplest geodetic measurements and stakeouts during the operation of mineral deposits.

3) *master the skills*: with geodetic instruments, performing angular, linear and altitude measurements on the ground, performing basic geodetic surveys, performing computational and graphic work when processing the results of geodetic measurements and solving engineering problems according to plans and maps .

## **Geoinformation technologies in geology**

THE CODE - GEO436

CREDIT - 5 (2/1/0/2)

PRE-REQUISITE - no

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### **PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course: to give theoretical and practical knowledge in the field of geoinformation technology in relation to the tasks of geology. Development of practical skills in modern geographic information systems.

Course objective: When studying the discipline, specialists should learn digital data processing technologies, technologies for creating and updating information databases, creating digital geological maps and plans

### **BRIEF DESCRIPTION OF THE COURSE**

The concept of geoinformatics . The concept of spatially-referenced information and the main ways to obtain it. Data of geographic information systems and ways to create a digital basis for geographic information systems. GIS software. Technologies for creating maps of geological content in geographic information systems. Remote basis of geological mapping.

### **KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students should

1) know:

- principles and methods of mathematical modeling in geology; main types of models and features of their application; computer analysis of geoinformation ;
- geoinformation systems in geological mapping;

2) be able to:

- to model the properties of geological objects;
- make maps for various purposes using GIS technologies

3) master the skills:

- construction of mathematical, physical and chemical models in solving production problems;
- Mapping using GIS technologies.



## **Geophysical methods of prospecting and exploration**

CODE - GE0411

CREDIT - 5 (2/1/0/2)

PRE-REQUISITE - no

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### **PURPOSE AND OBJECTIVES OF THE COURSE**

Purpose of the course: Geophysical methods of prospecting and exploration are widely used in solving the problems of geological mapping, prospecting and exploration of deposits of ores, non-metallic raw materials and hydrocarbons

Course objective:

As a result of studying this course, a geologist must learn the basics of geophysical methods, the principles of operation of measuring equipment, acquire the skills of independent work with geophysical materials, learn how to carry out their qualitative, and in some cases, quantitative interpretation. Most important for a geologist is the ability to creatively apply geological knowledge to explain the causes of geophysical anomalies.

### **BRIEF DESCRIPTION OF THE COURSE**

The physical-geological foundations, methods and techniques of work, processing and interpretation of the results of field, geophysical methods (electrical prospecting, magnetic prospecting, gravity prospecting, seismic prospecting, radiometry and nuclear geophysics) are outlined. The physical properties of rocks and the nature of the physical fields associated with them are considered. The principles of operation and the design of geophysical equipment, methods for performing field measurements and processing the data obtained are described, and the scope is indicated. Field geophysical measuring instruments require students to have knowledge of electrical engineering, electronic measurement systems. In terms of the volume of collected field geophysical data, their processing and interpretation requires the use of computer technologies.

### **KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students should

1) know:

- modern ideas about the geological nature of geophysical anomalies;
- methods of field geophysical work used in the search for mineral deposits;
- basic techniques for processing and interpreting the obtained geophysical data;
- basics of oil and gas potential forecasting based on geophysical data;

2) be able to:

- formulate tasks and substantiate the formulation of various types of field geophysical surveys;

- process, analyze and systematize field geophysical information using modern methods of its automated collection, storage and processing;
  - to carry out a forecast for the study area using geophysical data;
- 3) master the skills:
- methods of quantitative and qualitative analysis of geophysical fields;
  - skills of critical evaluation of scientific and scientific-technical information.

**Drilling of the wells**

CODE - PET406

CREDIT - 5 (2/1/0/2)

PRE-REQUISITE - no

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**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course: is to study the methods of drilling exploration, technical wells and water wells; fundamentals of well drilling technology; possible complications that arise during drilling of wells and affect their operation in the future; possible reserves to improve the quality of wells and reduce their cost.

Course objective: acquisition of knowledge in the development of well construction technology, well design and drilling modes, justification of the drilling fluid used, cementing parameters.

**BRIEF DESCRIPTION OF THE COURSE**

The discipline "Drilling wells" plays an important role in the formation of specialists who will be engaged in the search and exploration of mineral deposits for oil, gas, fresh and mineral waters, as well as for solid minerals. Knowledge of this discipline makes it possible to correctly determine the physical and mechanical properties of rocks, to choose the most rational rock cutting tools (bits, drill bits) and technical means for sampling cores from wells, to analyze the phenomena occurring in the process of well formation, to predict the performance of bits and drill columns.

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students should

1) know:

- basic terms and definitions, well design, well classifications;
- history, problems and prospects for the development of well drilling technology;
- technological processes of the production process of well construction;
- methodology for designing well design, calculation of casing strings and plugging to ensure the main technological processes.

2) be able to:

- apply methods of modeling technological processes of drilling wells;
- calculate well designs;
- develop well drilling technology;

3) master the skills:

- methods for constructing the simplest mathematical models of typical professional tasks;
- mathematical methods for solving natural science problems;
- draw up and draw up scientific, technical and service documentation.

## **Geology of mineral deposits**

CODE - GEO500

CREDIT - 5 (2/1/0/2)

PREREQUISITE – GEO194 General Geology

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### **PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course: the study of the geology of mineral deposits, the conditions for the formation of endogenous, exogenous and metamorphogenic deposits.

Course objective:

- study of geological and physico-chemical processes of ore formation and conditions of formation of deposits;
- study of the geological structure of deposits, conditions of occurrence and morphology of ore bodies;
- study of typomorphic features of deposits of different genetic types;
- study of the mineral composition of ores, textures and structures of ores of endogenous, exogenous and metamorphogenic deposits;
- familiarization with typical examples of industrial-genetic types of mineral deposits.

### **BRIEF DESCRIPTION OF THE COURSE**

Study of the geology of mineral deposits; conditions for the formation of endogenous, exogenous and metamorphogenic deposits; geological and physico-chemical processes of ore formation; geological structure of deposits, conditions of occurrence and morphology of ore bodies; mineral composition of ores, textures and structures of ores of endogenous, exogenous and metamorphogenic deposits; industrial-genetic types of mineral deposits and patterns of their placement for geological forecasting and determination of a rational set of methods for prospecting and exploration of deposits.

### **KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students must

- 1) know: geological, physico-chemical conditions for the formation of various genetic types of mineral deposits, their relationship with certain structural and material complexes of rocks, the mineral composition of ores and classical examples of deposits.
- 2) be able to: distinguish between genetic groups and classes of mineral deposits according to available geological and other indirect signs.
- 3) master the skills: to determine the genetic type of mineral deposits from the available samples of ores and host rocks.

**Fundamentals of prospecting and exploration of mineral deposits**

CODE - GEO429

CREDIT - 5 (2/1/0/2)

PREREQUISITE – GEO432 Structural Geology

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**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course: the formation of students' knowledge in the field of theoretical foundations of prospecting, exploration, testing of various types of minerals, calculating reserves and evaluating deposits at various stages of exploration, as well as acquiring by students the skills of interpreting the data obtained, allowing them to effectively search and explore mineral deposits fossils.

Course objective:

- industrial types of mineral deposits - the main objects of geological exploration;
- the main requirements of the industry for the geological and industrial assessment of mineral deposits;
- stages and stages of geological exploration, tasks and basic requirements for the maintenance of various stages;
- geological foundations of prospecting and exploration of mineral deposits;
- criteria for the potential ore content of the earth's interior, geological prospecting prerequisites and prospecting signs of mineral deposits;
- geological documentation in prospecting and exploration of mineral deposits;
- sampling of minerals, tasks and types of sampling, methods of sampling and methods of testing ores;
- classification of deposit reserves and predicted mineral resources;
- the main methods for calculating the reserves of deposits and assessing the predicted resources of minerals.

**BRIEF DESCRIPTION OF THE COURSE**

The main tasks of searches; geological prospecting prerequisites and signs of mineral deposits; methods of prospecting for mineral deposits; influence of natural conditions on the choice of search methods; rational integration of search methods. Main tasks and principles of exploration of mineral deposits; staging of exploration works; intelligence systems and density of the exploration network; reconnaissance technical means; geological documentation and sampling; conditions for calculating reserves; calculation of reserves of mineral deposits; classification of deposit reserves and predicted mineral resources.

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students must

- 1) know: the geological foundations of prospecting and exploration of mineral deposits; the specifics of exploration of various types of mineral deposits; design

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methods and production technology of exploration works; features of documentation of exploration workings; know the types and methods of testing mineral raw materials; basic methods for calculating mineral reserves; methods of organization, enterprise management; the state of the mineral resource base of the country and the prospects for its development.

2) be able to: correctly select and justify the methodology for conducting geological exploration in connection with the geological, mining and geographic and economic features of the research object; conduct geological and economic assessment of deposits at various stages of exploration; read graphs, diagrams, maps, diagrams, profile sections, horizontal plans characterizing the geological structure of deposits; carry out the calculation of reserves (resources) and technical and economic analysis of the processes of geological exploration and prospecting.

3) have the skills to: substantiate the methodology for conducting exploration work; to substantiate the density of the exploration network, the choice of a rational sampling methodology, the preparation of initial data for the calculation of reserves and the calculation of reserves by the main methods.

**Paleontology and historical geology**

CODE - GEO19 7

CREDIT - 4 (2/1/0/1)

PRE-REQUISITE - no

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**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course: development of students' geological outlook; creation of a basis for further obtaining special knowledge, skills and abilities in the process of studying all subsequent geological disciplines.

Course objective: obtaining general ideas about the structure of the Universe, the internal structure of the Earth, the geological activity of the main factors of its external and internal dynamics, the form of occurrence of geological bodies, tectonic movements and methods for their study, the main structures of the earth's crust.

**BRIEF DESCRIPTION OF THE COURSE**

The course "General Geology" considers the geological structure of the earth's crust; material (chemical, mineral and petrographic) composition of the earth's crust; the main structural elements of the earth's crust with their characteristic rock complexes; the main results of the most important endogenous and exogenous geological processes and their role in the formation of the earth's crust; forms of occurrence of geological bodies in the earth's crust, types of tectonic disturbances; methods of their representation on geological maps and sections, the concept of a geochronological (stratigraphic) scale.

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students should

1) know: the internal structure of the Earth,

- geological activity of the main factors of its external and internal dynamics,
- forms of occurrence of geological bodies, tectonic movements and methods for their study, types of structures of the tecton and lithosphere .

2) be able to:

- independently determine the most common minerals and rocks and explain their genesis;
- recognize simple tectonic structures, geological bodies and landforms;

3. own skills:

- work with a mountain compass;
- construction of geological maps of a simple structure and geological sections;

reading simple geological maps.

## Mathematical Methods in Geology

CODE - GEO428

CREDIT - 5 (2/0/1/2)

PREREQUISITE - Mathematics

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### PURPOSE AND OBJECTIVES OF THE COURSE

The purpose of teaching the discipline "Mathematical methods in geology" is the acquisition by students of theoretical knowledge on the basic mathematical methods used in the processing of geological, geochemical and other data obtained at different stages of geological research, the study by students of methods of mathematical modeling of the properties of geological objects and processes in solving applied and scientific tasks in different areas of geology.

Course objective:

### BRIEF DESCRIPTION OF THE COURSE

The discipline studies statistical methods for processing geological and geochemical data and patterns of distribution over the area and in space of calculated parameters, issues of object classification and pattern recognition, types of models and principles of modeling geological objects and processes, methods for building models based on data from various types of sampling, using modern computer technology.

### KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE

After studying the discipline, the student must have an idea:

- about the principles and methods of mathematical modeling in geology;

know:

- basic mathematical methods used in geology for statistical analysis and modeling of geological objects;
- main hypotheses and criteria for their verification;
- basic principles of mathematical modeling of geological objects and processes;
- types of mathematical models and features of their application in various fields of geology;

be able to:

- formulate geological problems in a form convenient for their solution using mathematical methods and modern computer technology;
- statistically evaluate geological objects;
- choose the optimal schemes for processing analytical and graphical data using mathematical methods;
- choose mathematical models that most fully reflect the properties of geological objects and the type of problem being solved.



**Oil and gas geology**

THE CODE - GEO 4 93

CREDIT - 4 (2/0/1/ 1 )

PREREQUISITE - GE0194    General Geology

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**PURPOSE AND OBJECTIVES OF THE COURSE**

Purpose of the course: Knowledge of the basics of geology, the structure of the earth's crust and upper sedimentary cover, rocks, the composition and physical properties of oil and gas, reservoir rocks and seals, the structure of natural reservoirs for oil, gas and water, traps, deposits and oil fields and gas, as well as the origin of oil and natural hydrocarbon gases.

The objective of the course: to familiarize students with the general patterns of geological and structural development of oil and gas regions, to study the main structural elements of deposits; to acquaint students with the hypotheses of the formation of oil and gas, the conditions and reasons for the migration of oil hydrocarbons, to study oil and gas structures.

**BRIEF DESCRIPTION OF THE COURSE**

Geology of oil and gas studies the origin, conditions of occurrence and geological history of combustible minerals. Provides knowledge about reservoir rocks and seals, natural reservoirs for oil, gas and water, traps, deposits and deposits of oil and gas. The conditions of oil and gas formation and oil and gas accumulation , migration, concentration and conservation of hydrocarbons in traps, as well as geological and geophysical methods of oil and gas prospecting are considered. On this basis, a scientific basis for prospecting, exploration and development of oil and gas accumulations is being developed.

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students must

1) know:

the main stages of the geological development of oil and gas provinces, the main similarities and differences between the main structural-tectonic zones.

2) be able to:

read the legend of geological and tectonic maps of different scales, highlight the areas of localization of oil and gas bearing territories; carry out geometrization of oil and gas deposits;

3) master the skills:

- in work with a series of geological maps and sections of various scales, as a means of understanding the structural elements of the Earth's crust.

## **Fundamentals of subsoil**

CODE - GEO443

CREDIT - 5 (2/0/1/2)

PREREQUISITE – GEO194 General Geology

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### **PURPOSE AND OBJECTIVES OF THE COURSE**

Purpose of the course: The purpose of studying the discipline "Fundamentals of subsoil use" is the acquisition by future specialists of the geological profile of knowledge on the issues of rational subsoil use within the framework of the legislation in force in the Republic of Kazakhstan.

Course objective:

- acquisition by students of knowledge of the Laws of the Republic of Kazakhstan: "On Subsoil and Subsoil Use", "On Licensing", "On Oil", etc., as well as Government Decrees regulating subsoil use operations;
- mastering the basic principles of rational subsoil use and familiarity with departmental instructions and reporting of subsoil users ;
- acquisition of skills and abilities for the practical application of the acquired knowledge when working in the specialty.

### **BRIEF DESCRIPTION OF THE COURSE**

Legislative framework for subsoil use in Kazakhstan. Ownership of subsoil, minerals and mineral raw materials. Competence of executive bodies in the field of subsoil use. Subsoil use right: types and subjects of law, its origin, provision and transfer. The procedure for granting the right to conduct exploration, production, combined exploration and production. Types, terms of validity, conclusion and execution of the contract. Work program as an integral part of the contract. Protection of mineral resources and the natural environment. Ecological basis for subsoil use operations. Safety of the population and personnel. State Subsoil Fund. Rights and obligations of a subsoil user . Ownership of information about the subsoil. Peculiarities of legal relations in carrying out operations for the exploration and production of oil, groundwater, precious metals and precious stones, and other minerals. Taxation of subsoil users

### **KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students must

- 1) know: the main goals, objectives and principles of subsoil use in the Republic of Kazakhstan. Know all types of subsoil use operations, sources of their financing, as well as the system of taxation of subsoil users . To know the content of the state subsoil fund of the Republic of Kazakhstan.
- 2) be able to: draw up the necessary documents for obtaining the right to subsoil use and the draft Subsoil Use Contract.

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3) have the skills to: monitor the operation of subsoil use.

## **Hydrogeology and engineering geology**

CODE –GEO492

CREDIT - 4 (1/0/1/2)

PREREQUISITE – GE0 194 General Geology

### **PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course: to familiarize students with fundamental and applied problems of hydrogeology, issues of theory, methodology and practice of hydrogeological research in the search and exploration of deposits of solid minerals, oil and gas. The acquisition of theoretical knowledge about the engineering-geological features and properties of rocks, the geological and engineering-geological processes occurring in these rocks, the engineering-geological conditions of various territories, the study of which is necessary in order to predict their changes during economic development.

Course objective: - study of the conditions of occurrence, movement and formation of natural waters in the lithosphere; study of the theoretical foundations of hydrogeology; study of hydrogeological aspects of environmental protection.

### **BRIEF DESCRIPTION OF THE COURSE**

Components of hydrogeology; physical properties and chemical composition of groundwater; methods of processing chemical analyzes of natural waters and forms of their display; types of movement of waters and brines in the earth's crust; aqueous solutions in the lithosphere; hydrogeological basins and geohydrodynamic systems; useful waters in the bowels; hydrogeological surveys and research; paleohydrogeology ; hydrogeological conditions of migration, accumulation, ecological hydrogeology.

### **KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students must

1) know:

- characteristics of groundwater, their properties and relationships with each other,
- communication with the atmosphere and underground hydrosphere,
- the field of nutrition and their distribution;
- purpose of their application.

2) be able to:

- conduct searches, exploration and evaluation of operational groundwater reserves for the purpose of water supply of settlements, agricultural and industrial enterprises;

3) master the skills:

providing a scientific basis for long-term planning of geological exploration, hydrogeological and other works.

## CATALOG OF ELECTIVE DISCIPLINES

### **Geological mapping**

THE CODE - GEO 440

CREDIT - 5 (2/0/1/2)

PREREQUISITE – GEO432 Structural Geology

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#### **PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course: mastering the techniques and methods of geological survey, as one of the main means of understanding the geological structure of the earth's crust; acquiring skills in analyzing available geological materials and identifying the prospects of the studied areas in relation to the discovery of minerals; familiarization with the content of general searches for geological surveys; obtaining knowledge on the organization and production of geological surveys of various scales and the basic requirements for them; formation of skills to work with geological graphics and prepare reporting materials.

Course objective:

- getting students a solid knowledge of the theory and practice of geological surveying and compiling geological maps;
- familiarization with special methods and features of surveying in various geological and geographical conditions and in the areas of development of rocks of various origins;
- mastering the methods of facies-genetic, structural and historical-geological analysis.

#### **BRIEF DESCRIPTION OF THE COURSE**

Mastering the methods of field geology, geological surveying and compiling geological maps, equipment and technology of field geological research. Special methods of geological surveys in the areas of development of sedimentary, volcanogenic, intrusive and metamorphic rocks. Features of shooting in various geological and geographical conditions. Analysis of the geological structure of a block of the earth's crust, drawing up geological graphics and an explanatory note to it. Methods of geological interpretation of materials from aerial and space surveys. Mastering the methods of facies-genetic, structural and historical-geological analysis.

#### **KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students must

- 1) know: methods of field geology, methods of geological survey and compilation of geological maps, techniques and technology of field geological research.
- 2) be able to: read geological maps, build geological sections, conduct geological surveys and compile geological maps of various scales, decipher materials from aerial and space surveys.

Designed by:	Reviewed: meeting of the Institute	Approved by: EMC KazNRITU	Page 77 of 118
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3) master the skills of: compiling geological maps of various scales, conducting geological surveys, analyzing available geological materials and identifying the prospects of the studied areas in relation to the discovery of minerals.

**Physics of oil reservoir**

THE CODE - GEO 448

CREDIT - 5 (2/0/1/2)

PREREQUISITE - Physics

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**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course: to give students the theoretical and experimental scientific foundations necessary to understand and control the physical processes that occur in reservoirs during well construction and fluid filtration.

The objective of the course: to prepare students for independent analysis of the physical properties of reservoirs and fluids, physical processes occurring in the reservoir during fluid filtration to justify and optimize the technology of oil and gas field exploitation.

**BRIEF DESCRIPTION OF THE COURSE**

Field preparation for exploitation, which is based on the knowledge of sedimentary rocks, reservoirs, oil and gas and their physical properties, as well as the specific surface of rocks, carbonate content of rocks, porosity, permeability, laws of motion in the reservoir of a mixture of oil, water and gas, natural regimes deposits, mechanical and thermal properties, electrical and radioactive properties of rocks. The physicochemical properties of oil, gas, and formation waters are considered. The issues of application of methods of enhanced oil recovery and methods of influencing the bottomhole zone of wells are being addressed.

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students should

1) know:

- main production processes representing a single chain of oil and gas technologies;
- basic properties of oil hydrocarbons, hypotheses of organic and inorganic origin of oil and gas, principles of classification of oils and gases, properties and patterns of behavior of disperse systems;
- principles of using the physical properties of the reservoir to solve engineering problems of the oil and gas profile;

2) be able to:

- determine the value of the physical and parametric properties of the formation and formation fluids;
- methods for studying the physicochemical and mechanical properties of rocks in air and in contact with various liquids;
- know the characteristics of the main physical properties of reservoir rocks by the principles of interpreting data from geophysical well surveys

3) master the skills:

- analysis of the principles of classification of oil and gas systems .



## **Crystaloptics**

THE CODE - GEO 441

CREDIT - 5 (1/2/0/2)

PREREQUISITE – GEO 434 Petrography

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### **PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course: crystal optics, obtaining knowledge about the methods of studying rocks using a polarizing microscope and skills in compiling petrographic descriptions.

Course objective:

- to teach students the basics of crystal optics;
- to instill in them practical skills in working with a polarizing microscope;
- to teach students the use of the main methods of crystal-optical research;
- teach them to identify minerals under a microscope.

### **BRIEF DESCRIPTION OF THE COURSE**

Polarized light and polarizers; polarizing microscope; refraction and birefringence of light in minerals; related optical properties of minerals and their determination; petrographic characterization of ultrabasic, basic, intermediate, acidic and foid rocks; conditions of formation and their study using a polarizing microscope; sedimentary rocks, petrographic characteristics of detrital, clayey, chemogenic and biogenic rocks, formation conditions and their study using a polarizing microscope; petrographic characterization of metamorphic rocks of cataclastic contact-thermal, regional metamorphism and metasomatites and their study using a polarizing microscope.

### **KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students should

1) know:

- history, subject, tasks and methods of studying igneous, metamorphic and metasomatic rocks;
- Fundamentals of crystal optics and methods of crystal optical diagnostics of minerals, their optical constants;
- modern scientific ideas about the processes of magmatism , metamorphism and metasomatism;
- classification and main types of igneous, metamorphic, metasomatic rocks;
- microscope device;
- the principle of constructing an optical indicatrix;

2) be able to:

- use a polarizing microscope in transmitted light;
- generalize the parameters of minerals and diagnose them under a microscope (microstructures and microtextures), various rocks.

- to reconstruct the conditions of formation of rocks and the primary composition of magma;
  - analyze mineral associations
  - to interpret the obtained data on breeds in accordance with modern classifications.
- 3) master the skills:
- organizational skills;
  - ability to find a common language and work in a team;
  - The ability to make quick decisions and self-confidence.

## **Lithology, diagenesis and biofacies of oil and gas basins**

THE CODE - GEO 442

CREDIT - 5 (2/0/1/2)

PREREQUISITE – GEO 434 Petrography

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### **PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course: Formation of students' knowledge and skills, development of competence in the field of composition and structure of sedimentary rocks, the geological bodies they compose, the origin and patterns of their spatial and geochronological distribution, favorable conditions for the formation of oil and gas fields.

Course objective: Studying the classification of sedimentary rocks, types of lithogenesis, methods of lithological studies of rocks, the main stages of the formation and transformation of sedimentary rocks, determining and describing the composition, structure and texture of rocks, generalizing analytical data.

### **BRIEF DESCRIPTION OF THE COURSE**

Lithology and oil and gas sedimentology is one of the main disciplines required for a specialty that studies issues affecting the material composition, structural and textural features, formation conditions, stages of lithogenesis, sedimentation conditions and sedimentation conditions, as well as the relationship of rocks with oil and gas fields. The causes and conditions for the occurrence of oil-bearing and source rocks, as well as the periodicity of sedimentation, are studied. In addition to the theory of lithogenesis, students must acquire the skills to describe the main varieties of sedimentary rocks in samples and thin sections, using a polarizing microscope and other laboratory methods.

### **KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students should

1) know:

- methodology for determining the types of sedimentary processes and conditions of sedimentation and their stratigraphic features;
- study of the transfer and transportation of clastic material;

2) be able to:

- determine the features and varieties of oil and gas traps;
- types of rocks composing them, to determine the conditions of sedimentogenesis;
- collector distribution systems;

3) master the skills:

- construction of litholo- stratigraphic sections, paleogeographic maps, lithological analysis and its application in practice .

**Theoretical bases and applied aspects of well logging**

THE CODE - GPH 418

CREDIT - 7 (2/1/0/2)

PRE-REQUISITE - no

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**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course: the formation of knowledge about the physical nature and scope of electrical, radiometric, acoustic and other geophysical methods for studying oil and ore wells.

**BRIEF DESCRIPTION OF THE COURSE**

The basics of integration of geophysical research methods for specific types of deposits are given. The technique and methodology of well logging, technical conditions for logging, principles and methodology of integration are described. Methods for studying the technical condition of wells and methods for monitoring the development of deposits are considered. As part of the course, the student will master the theoretical foundations and applied aspects of geophysical well survey methods (GIS) in the search and exploration of mineral deposits, the physical essence of well logging methods, the principles of work, the types of equipment currently used in the areas of application of geophysical well survey methods . Basic knowledge and skills in the field of geophysics, geology, petrophysics , physics, as well as methods of well research in the search and exploration of mineral deposits will be presented.

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students should be able to:

- read GIS diagrams
- assess the filtration properties of rocks
- be able to determine the boundaries and thicknesses of ore bodies
- be able to process GIS diagrams, etc.

At the end of the course the student should know:

- petrophysics of rocks;
- classification of GIS methods and principle of operation;
- physical foundations of GIS;
- modern GIS equipment;
- the principle of integration of well logging methods, etc.

**Geophysical exploration (well logging) of uranium deposits**

THE CODE - GPH419

CREDIT - 5 (2/1/0/2)

PREREQUISITE – GE0411 Geophysical prospecting and exploration methods

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**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course: is to study the increase in the geological efficiency of geophysical work on uranium deposits of infiltration type .

**BRIEF DESCRIPTION OF THE COURSE**

This discipline forms knowledge about the physical nature and scope of well logging methods in the search and exploration of uranium deposits. It highlights the role of well logging in solving geological problems - lithological and stratigraphic subdivision of well sections, identifying uranium deposits and determining their physical properties and inter-well correlation. It outlines the geochemical and nuclear-physical properties of uranium, petrophysical models of uranium deposits of the main industrial types, geophysical methods of research in wells during the exploration and development of uranium deposits by the method of underground borehole leaching.

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students should be able to:

- - read GIS diagrams
- - evaluate the filtration properties of rocks
- - be able to determine the boundaries and thicknesses of ore bodies
- - be able to interpret diagrams of the GK, KS, PS, IK, TK, TM, INCL, etc.
- - know the principle of calculating stem reserves

At the end of the course the student should know:

- - petrophysical models of uranium deposits and conditions for their localization;
- - modifications of geophysical surveys in wells during exploration and development of uranium deposits;
- - geophysical support of the method of underground borehole leaching of uranium
- - method of lithological subdivision of rocks and correlation of sections
- - methodology for assessing the filtration properties of rocks
- - methodology for assessing the radioactive balance in uranium ores
- - methodology for determining the boundaries and thickness of ore bodies.

**Modern geophysical technologies for calculating reserves of uranium deposits**

THE CODE - GPH420

CREDIT - 7 (2/1/0/2)

PREREQUISITE – GE0411 Geophysical methods of prospecting and exploration methods

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**PURPOSE AND OBJECTIVES OF THE COURSE**

Course objective: practical use of logging data, processing and interpretation of geophysical data of uranium deposits, as well as the skills of lithological dissection of the section along the wellbore and compiling a reserve estimate.

**BRIEF DESCRIPTION OF THE COURSE**

This discipline instills skills in the use of personal computers and software technologies in the processing of well logging data and the possibility of using the results of well logging in the mining and extraction of uranium by the method of underground well leaching.

The discipline covers the general methodological provisions for calculating the reserves of ore deposits and the specifics of calculating the reserves of uranium deposits, the features of the choice of standard indicators, the principles of contouring ore deposits, and the calculation of average parameters.

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students should be able to:

- - read GIS diagrams
- - evaluate the filtration properties of rocks
- - be able to determine the boundaries and thicknesses of ore bodies
- - be able to interpret diagrams of the GK, KS, PS, IK, TK, TM, INCL, etc.

At the end of the course the student should know:

- - petrophysical properties of coal and uranium deposits and conditions of their localization;
- modification of geophysical surveys in wells during exploration and development
- ore deposits;
- method of lithological subdivision of rocks and correlation of sections
- methodology for assessing the filtration properties of rocks
- methodology for determining the boundaries and thickness of ore bodies.

**Mining**

THE CODE - MIN 515

CREDIT - 7 (2/1/0/2)

PRE-REQUISITE - no

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Course objective:

O possession of mining terminology, mastering the principles of mining operations in open, underground and borehole mining of mineral deposits, the basic concepts of mineral processing

The objective of the course: obtaining in-depth knowledge of the current state, main directions and prospects for the development of mining industries, terminology and production technology in the underground mining method.

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**BRIEF DESCRIPTION OF THE COURSE**

Prospects for the development of underground mining of mineral deposits. Mining and geological characteristics of mineral deposits. Dimensions and occurrence elements of ore deposits. Basic information about mining operations in the underground development of the deposit. Main indicators of ore extraction. Loss and impoverishment of ore. The concept of a mine field, a mine. Stages of development of mine fields. Opening of ore deposits. Opening requirements. Revealing workings of ore deposits. Opening by vertical , inclined shafts , combined opening methods. The main production processes of the stope excavation. The concept and classification of systems for the development of ore deposits. requirements for them. Open Mined Systems. Choice of system of underground mining of ore deposits.

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**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students should

1) to know: the relative position in space of all mine workings, which is a necessary condition for the creative study of the issues of opening and preparing mine fields, development systems for various mining, geological and mining conditions of deposits

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2) be able to: assess the mining and geological conditions of mining operations, have an initial understanding of the methods of developing mineral deposits.

3) master the skills: calculate the main processes , apply the main and auxiliary processes depending on the mining, geological and mining conditions of the deposit , choose rational methods for opening and preparing ore deposits.

## **Geological and industrial types of mineral deposits**

THE CODE - GEO 494

CREDIT - 7 (2/1/0/2)

PREREQUISITE - GE0429 Fundamentals of Prospecting and Exploration of Mineral Deposits

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### **PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course: the formation of students' knowledge in the field of industrial use of various types of metallic and non-metallic minerals, consumer requirements for their quality and quantity, the principles of technological and industrial typification of ores, and the allocation of industrial genetic types of minerals by type of minerals.

Course objective:

- familiarization of students with the state and prospects for the development of the mineral resource base of the Republic of Kazakhstan;
- familiarization of students with industrial classifications of mineral deposits;
- study of the geological structure of deposits and morphology of ore bodies;
- study of the mineral and chemical composition of ores, their application in industry;
- study of the basic requirements of industry for mineral deposits;
- familiarization of students with examples of industrial and genetic types of mineral deposits.

### **BRIEF DESCRIPTION OF THE COURSE**

Status and prospects for the development of the mineral resource base of Kazakhstan. Industrial types of deposits. Industrial classification of deposits. Basic industry requirements for mineral deposits. Industrial types of ferrous metal deposits. Industrial types of deposits of alloying metals. Industrial types of non-ferrous metal deposits. Industrial types of noble metal deposits. Industrial types of deposits of radioactive elements. Industrial types of deposits of rare metals. Industrial types of deposits of non-metallic minerals. Industrial types of fossil fuel deposits.

### **KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students must

- 1) know: features of the geological structure, geological and structural conditions for the localization of the main types of industrial deposits of various types of metallic and non-metallic minerals.
- 2) be able to: according to the geological and structural features, the material composition of the ores and the characteristic complexes of the host rocks, to attribute this deposit to a certain geological and industrial type.



3) to have the skills: to determine its geological and industrial type based on the existing collections of ores and host rocks, given the geological and structural features of the deposits.

## **Geodynamics of lithospheric plates**

THE CODE - GEO 495

CREDIT - 7 (2/1/0/2)

PREREQUISITE – GEO 432 Structural Geology

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### **PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course: students' assimilation of geodynamic and tectonic processes that are the causes of deformations of the earth's crust, understanding of the processes that form various geological structures, as well as the processes leading to the distribution of heat flow in sedimentary basins and varying degrees of subsidence in them.

The objective of the course is to conduct practical exercises with students necessary for acquiring knowledge and skills that will help determine various tectonic regimes, as well as for using geographic information systems (GIS) in order to create geological databases and interpret remotely obtained images.

### **BRIEF DESCRIPTION OF THE COURSE**

Geodynamics studies the deep forces and processes that arise as a result of the evolution of the Earth as a planet and determine the movement of masses of matter and energy inside the Earth and in its upper solid shells. Considers the structure of the Earth, convective movements in the Earth's mantle, lithospheric plates and their boundaries; the emergence of continental rifts, their transformation into marine basins and oceans; spreading, subduction, obduction, collisional environments; evolution of sedimentary basins; geodynamic models of oil and gas formation. On this basis, the identification of hydrocarbon resources of the earth's interior.

### **KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students should

1) know:

Plate tectonics, plate movements, forces that move tectonic plates; distribution of compression and tension forces in the lithosphere, strength of the lithosphere; the causes of earthquakes, and how information taken from them can be used in understanding tectonic processes;

2) be able to:

Use potential fields (gravity and magnetism) to study the bowels of the earth; create geological databases using GIS.

3) master the skills:

Interpretation of the deformed earth's surface using remotely acquired images.

**Computer technologies in geology**

THE CODE - GEO 451

CREDIT - 7 (1/2/0/2)

PREREQUISITE - GE0429 Fundamentals of Prospecting and Exploration of Mineral Deposits

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**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course: to give theoretical and practical knowledge in the field of computer technology in relation to the tasks of geology.

Course objective:

- to give theoretical and practical knowledge in the field of computer technology in relation to the tasks of geology;
- development of preliminary knowledge about the main concepts of construction
- geological maps, sections, stratigraphic column, etc.;
- deepening technological education in the field of computer technology;
- obtaining general ideas about the use of computers in geology;
- development of practical skills in modern geology.

**BRIEF DESCRIPTION OF THE COURSE**

Creation of geological maps in the geological industry, which are qualitatively more advanced cartographic models that reflect modern knowledge about the geological structure of individual blocks of the earth's crust and are the fundamental geological basis for creating all types of specialized maps of geological content. The discipline "Computer technologies in geology" allows students to acquire knowledge about the methods of the process of digital mapping and spatial referencing; ability to work in design programs for drawing up stratigraphic columns and schemes that do not require spatial reference; skills in compiling digital maps of various content and purpose; competently work with MapInfo , CorelDraw programs

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students must

- 1) know: methods for compiling and digitizing graphic geological material and spatial references of geological maps.
- 2) be able to: be able to competently work with a variety of geological graphics in computer performance in various modern computer technologies ( ArcGJS , MapInfo , Coreldraw ).
- 3) master the skills: compiling and digitizing graphic geological material and spatial references of geological maps.

## **Oil and gas areas in Kazakhstan**

THE CODE - GEO 462

CREDIT -7 (2/0/1/2)

PREREQUISITE – GEO 493 Oil and gas Geology

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### **PURPOSE AND OBJECTIVES OF THE COURSE**

The main goal of the discipline is to study the geological structure of the oil and gas bearing regions of Kazakhstan, the features of the structure and formation of natural reservoirs, the stratigraphic affiliation, the lithology of the oil and gas bearing horizons of individual fields.

### **BRIEF DESCRIPTION OF THE COURSE**

Discipline about the regularities of the distribution of oil and gas areas, the features of the distribution of oil and gas accumulations along the section and area. The natural connections of the tectonic structure with the features of lithogenesis and oil and gas potential are considered. The formation and location of oil and gas fields are in close genetic connection with the conditions for the formation of oil and gas bearing sedimentary basins. The oil and gas geological zoning in Kazakhstan is given on the basis of plate tectonics. Sedimentary basins that are promising in terms of oil and gas are considered.

### **KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

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

- about industrially oil and gas bearing and perspective territories of Kazakhstan;
- about the structure of natural reservoirs and traps for oil and gas;

The student must be able to:

- interpret field geological and geophysical methods, GIS;
- map oil and gas traps;
- solve standard problems in the field of search and exploration of oil and gas;
- conduct a comparative assessment of objects prepared for drilling in order to select priority ones;

At the end of the course the student should know:

- methods for obtaining and analyzing geological and geophysical information;
- types of oil and gas traps in various oil and gas regions;
- a rational set of exploration methods for oil and gas in promising areas;
- ways to solve standard problems in the field of search and exploration of oil and gas.

## **Oil and gas provinces of the world**

THE CODE - GEO 462

CREDIT - 7 (2/0/1/2)

PREREQUISITE – GEO 493 Oil and gas geology

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### **PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course: Generalization and analysis of comprehensive geological and field information about oil and gas fields and deposits in the initial state and in the development process for the geological and technical justification of the most effective development systems and maximum extraction of oil and gas from the subsoil.

Course objective:

- The course "Oil and Gas Provinces of the World" is the most important major discipline that determines the professional training of mining geologists in the specialization "Oil and Gas Geology".

- On the example of specific oil and gas areas of the world, students study the main features of the distribution of oil and gas accumulations along the section and area within geostructural elements of various types, thereby establishing regular relationships between the specifics of tectonic and lithogenesis, as well as the nature of the oil and gas potential of individual regions.

### **BRIEF DESCRIPTION OF THE COURSE**

In the discipline oil and gas provinces of the world, the tasks of oil and gas geological zoning are solved. Oil and gas provinces, ancient and young platforms are distinguished. Volga-Ural, Timan-Pechora, Caspian, Central Kazakhstan, Dnieper-Pripyat , Baltic, Lenno-Vilyui, Leno-Tungusskaya oil and gas fields, oil and gas provinces of young platforms, West Siberian, Ciscaucasian -Crimean (Scythian) oil and gas fields and Turan gas oil fields , oil and gas fields provinces of folded and transitional territories, Transcaucasian, West Turkmen, Far Eastern, Cis-Urals , Cis-Carpathian NGP. oil and gas provinces of foreign countries. NGP of North and South America, Near and Middle East.

### **KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students should

1) know:

- features of the development of oil, gas and gas condensate deposits;
- geological and commercial substantiation of the allocation of operational facilities and floors;
- geological and technological factors.

2) be able to:

- build and analyze structural maps, calculation plans, geological and geophysical profiles, correlation schemes, isopach maps, isobar maps

- analyze the geological and commercial characteristics of productive horizons, production facilities and development stages;

3) master the skills:

analysis of geological and geophysical information, geological services for all geological operations during the drilling of reference, parametric, prospecting and exploration wells.

**Geochemical methods of exploration of mineral deposits**

THE CODE - GEO 453

CREDIT - 7 (2/0/1/2)

PREREQUISITE - GE0429 Fundamentals of Prospecting and Exploration of Mineral Deposits

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**PURPOSE AND OBJECTIVES OF THE COURSE**

The objectives of mastering the discipline "Geochemical methods of prospecting" is to familiarize with the geochemical methods of prospecting for mineral deposits, which play an important role at all stages of the exploration process. The discipline involves the study of the possibilities of geochemical methods and the sequence of their implementation.

**BRIEF DESCRIPTION OF THE COURSE**

Theoretical foundations of geochemical methods of prospecting. Classification of geochemical search methods

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

Upon completion of the course, the student must demonstrate the ability to analyze:

- internal and external factors of element migration,
- general patterns of formation of primary and secondary lithochemical dispersion halos,
- and also to be able to calculate the dispersion haloes of elements in the earth's crust.

Based on research data, the most rational method of prospecting and discovering mineral deposits can be selected.

The student should be able to: on the basis of the theoretical foundations of geochemical methods, selects the most rational method of prospecting for the discovery of deposits of solid minerals, depending on specific geological and landscape-geochemical conditions.

At the end of the course the student should know:

- forms of finding elements in the earth's crust;
- assimilation of the main factors of element migration;
- geochemical methods of prospecting for mineral deposits.

**Theoretical basis for searching and exploration of oil and gas fields**

THE CODE - GEO 456

CREDIT - 7 (2/0/1/2)

PREREQUISITE GEO 493 Oil and gas geology

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**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course: to master the theoretical foundations of forecasting the oil and gas potential of the subsoil, petrogeological zoning, oil and gas formation and oil and gas accumulation ; master the geological prerequisites for the formation and placement of regional oil and gas complexes.

Course objective:

- to study and summarize the structure and staging of exploration work for oil and gas;
- to study the geological prerequisites for the formation and placement of regional oil and gas complexes.

**BRIEF DESCRIPTION OF THE COURSE**

The theoretical foundations of the methods of prospecting and exploration of hydrocarbon deposits (oil, gas, condensates), as well as the main complex of geological and geophysical studies during prospecting and exploration are considered.

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students must

1) know:

- basics of oil and gas content forecasting ;
- oil and gas geological zoning.

2) be able to:

- analyze and summarize geological and geophysical materials, tabular data, graphic materials: maps, diagrams, well logs;
- to give a preliminary assessment of the prospects for oil and gas ;

3) master the skills:

analysis, interpretation and generalization of geological and geophysical information.



**Laboratory methods for studying minerals**

THE CODE - GEO 496

CREDIT - 7 (1/2/0/2)

PREREQUISITE – GEO Petrography

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**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course: Acquisition of knowledge by students on the microscopic study of ores of various genetic types of deposits. Master the theory and practice of microscopic examination of ores. To teach students the skills of self-diagnosis of ore-forming minerals in reflected light and the ability to use key tables that can be used to determine the mineral under a microscope. To instill the basic techniques in the study of textural and structural analysis, paragenetic mineral associations, typomorphism of minerals. To acquaint with modern methods of mineralogical research, which open up great opportunities in solving genetic and applied problems.

Course objective:

- determination of the mineral composition of ores and elucidation of the regularities of its change in various parts of the ore body;
- study of the typomorphism of the main ore-forming minerals;
- study of the regularities of distribution and determination of the dimension of valuable components in ores and main ore minerals;
- identification of various types of ores and their constituent paragenetic mineral associations, their placement in the deposit;
- characteristics of the structural features (texture and structure) of the ore;
- elucidation of the sequence of mineral formation

**BRIEF DESCRIPTION OF THE COURSE**

A special discipline on the methods of diagnostics of mineral matter, studies of the physical and chemical composition of ores, their structural, textural and other features that determine their quality and affect the technology of extraction and processing. Ore microscopy, spectral and X-ray structural analysis, thermal analysis, petrophysical methods, study of gas-liquid inclusions, cryometry, decrepitation, sludge method: their capabilities and requirements for sample quality. Applications of these methods in practical geology and methodology.

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students should

1) know:

- diagnostic properties of ore-forming minerals in reflected light
- the principle of key tables,
- textures and structures of ores,

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- paragenetic mineral associations,
- typomorphism of minerals.

2) be able to:

- determine ore minerals by diagnostic properties and key tables using a microscope;
- analyze the structural and textural features of the structure of ores and paragenetic associations;
- based on the studied composition of ores and structure, be able to restore the genesis and order of ore formation.

3) master the skills:

- complex mineralogical research, thanks to which genetic and applied problems are solved.

## **Geodynamics of oil and gas pools**

THE CODE - GEO 497

CREDIT - 7 (2/0/1/2)

PREREQUISITE – GE0493 Oil and gas geology

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### **PURPOSE AND OBJECTIVES OF THE COURSE**

The main purpose of studying the discipline "Geodynamics of oil and gas basins" is to consider models of processes occurring in the crust and mantle of the Earth; familiarization with the methods of modern geodynamics; familiarization with models of the formation of sedimentary basins of various types.

Course objective:

the student must have basic knowledge of the models of subsidence of the earth's crust, structure, geodynamic settings for the formation and evolution of sedimentary basins; knowledge and relationships of the structure of sedimentary basins.

### **BRIEF DESCRIPTION OF THE COURSE**

Methods for describing tectonic processes occurring in the surface shells of the Earth. Thermal convection. Convection in the Earth's mantle. Connection of motions in the mantle and in the asthenosphere. Driving forces of plate tectonics. Use of global seismic tomography data. Geodynamics of sedimentary basins. Classification of sedimentary basins and their internal structure. Dive curves. Mathematical theory of paleotectonic analysis. The main processes that may be associated with the formation of sedimentary basins. Principles of classification and types of sedimentary basins. Stresses in the lithosphere. Peculiarities of stress distribution in the lithosphere.

### **KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students should be able to:

- determine and use the possibilities of applied geodynamics in solving specific geological and practical problems of identifying, prospecting and evaluating oil and gas fields,
- carry out processing of field and analytical data, use empirical and theoretical diagrams and models of typical conditions for the formation of structural-material complexes in the construction of tectonic maps for predictive assessment of territories.

Upon completion of the course, the student should know: the basic provisions, principles and physical foundations of the theory of "Tectonics of lithospheric plates" and models of the formation of sedimentary basins, modern terminology and methodology of the concepts of "Geodynamics of oil and gas basins",

- knowledge of the geodynamic conditions of the formation of structural-material complexes in the earth's crust.

**Geological and economic evaluation of mineral deposits**

THE CODE - GEO 454

CREDIT - 7 (2/0/1/2)

PREREQUISITE - GE0429 Fundamentals of Prospecting and Exploration of Mineral Deposits

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**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of studying the discipline: teaching students how to correctly assess mineral deposits, including the assessment of geological factors (quantity, quality, technological properties of minerals, mining and geological conditions for mining and the geographical and economic position of deposits), as well as the fundamental features of mining based on mining rent, markets for mineral raw materials and other modern economic indicators.

**BRIEF DESCRIPTION OF THE COURSE**

Introduction. Fundamentals of research and use (geological and economic assessment) of subsoil in the Republic of Kazakhstan. Laws and regulations of the Republic of Kazakhstan - guidance materials, according to the geological and economic assessment of mineral deposits. Stages and stages of exploration work. Criteria of industrial value of mineral deposits. reconnaissance methods. Assessment of the variability of the properties of minerals. Technical means of geological study in the evaluation and exploration of solid mineral deposits. Examination of geological minerals. Classification of mineral reserves. Conditions for mineral raw materials and their impact on reserves and quality. Assignment of conditions. Material counting. Comparison of exploration data with the results of field exploitation.

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

Expected results: students mastering the theory, methods and technology of geological support for the evaluation of mineral deposits at the selected stages of geological exploration (search and evaluation; exploration and development); the formation of the necessary practical skills in students in the areas determined by the main goal of the course.

**Oil and gas geology and estimation of reserves**

THE CODE - GEO 449

CREDIT - 7 (2/0/1/2)

PREREQUISITE – GEO 493 Oil and gas geology

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**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course: Generalization and analysis of comprehensive geological and field information about fields and deposits of oil and gas in the initial state.

Course objective:

In the process of development for the geological and technical justification of the most effective systems for the development and maximum extraction of oil and gas from the bowels.

**BRIEF DESCRIPTION OF THE COURSE**

To carry out geological services for all geological operations when drilling wells at all stages of the geological exploration process for oil and gas, to predict the prospects of territories in terms of oil and gas bearing.

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students must

1) know:

- features of the development of oil, gas and gas condensate deposits;
- geological and commercial substantiation of the allocation of operational facilities and floors;

2) be able to:

- analyze the features of the development of oil, gas and gas condensate deposits;
- draw up a geological and commercial justification for the allocation of operational facilities and floors;

3) master the skills:

geological services for all geological operations when drilling wells at all stages of the exploration process for oil and gas.

**Mine geology**

THE CODE - GEO 458

CREDIT - 8 (2/2/0/2)

PREREQUISITE - GE0429 Fundamentals of Prospecting and Exploration of Mineral Deposits

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**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course: To teach knowledge, skills and decision-making in geological support and provision of exploration and mining.

Course objective:

a comprehensive geological study of the exploited deposit and its individual parts and blocks for the correct solution of all mining and geological issues related to the technically correct and expedient development of the deposit with the most complete and comprehensive use of minerals and to extend the life of mining enterprises due to the growth of additional reserves.

**BRIEF DESCRIPTION OF THE COURSE**

The subject of study of mine geology is prepared for industrial development and exploited mineral deposits. Within the limits of mining allotments of mines and quarries, operational exploration of deposits is carried out in order to provide mining enterprises with explored mineral reserves. During operational exploration and development of deposits, geological documentation and testing of minerals will be carried out. During the exploitation of deposits, the calculation and accounting of the movement of reserves, losses and impoverishment of minerals, the comparison of exploration and exploitation data are carried out.

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students should

1) know:

- basic methods and methods of geological support and support of exploration and mining operations in the design, construction and development of deposits of solid minerals;
- basics of geological documentation, testing of mining and exploratory workings and natural outcrops of rocks and ores;
- basic methods for calculating the reserves of various types of solid minerals;
- drawing up a balance of reserves and reporting on the fulfillment of license and contract conditions;

2) be able to:

- carry out work on the calculation of reserves of solid minerals for blocks, horizons, sections, grades;

- to allocate to calculate commercial reserves: discovered, prepared for extraction and ready for extraction and their rationing;
- draw up state reports on reserves, according to the conditions for fulfilling license and contract conditions.

3) possess skills: ability to work in a team; organization of geological work during mining operations.

## **Geochemistry of organic matter and hydrocarbons in oil and gas basins**

THE CODE - GEO 459

CREDIT - 8 (2/0/1/2)

PREREQUISITE – GEO 493 Oil and gas geology

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### **PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course: a section of geochemistry that studies the prevalence, form of presence, origin, composition and chemical evolution of organic compounds in geological conditions.

Course objective: to study the chemistry of the process of transformation of living matter into fossil forms ( including under the action of microorganisms), the study of the conditions and factors that determine the formation of different types of this substance (humus, sapropel, etc.), as well as the mechanisms of further transformation organic matter into rocks under the influence of heat, pressure, seismic, lithological and other geological factors leading to the formation of combustible minerals.

### **BRIEF DESCRIPTION OF THE COURSE**

The content of the course is aimed at studying the sources of hydrocarbons in the subsoil and their role in sedimentary strata, types of high-molecular hydrocarbon compounds inherited from living organisms ; biomolecular compounds; the concept of the oil system, the correlation of oils and organic matter residues based on paleobiomarkers ; increasing the efficiency of the study of sedimentary basins in order to identify areas promising for oil and gas.

### **KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students should

1) know:

- the main hypotheses of the organic and inorganic origin of oil, the composition of bioproducers and their role in the formation of the source material;

2) be able to:

- identify oil and gas complexes, determine the types of migration and their driving forces; processes of transformation of oils in deposits;

3) master the skills:

– use of modern methods for studying the core of oil and gas wells.



**Geomorphology and anthropogenic geology**

THE CODE - GEO 461

CREDIT - 8 (2/0/2/2)

PREREQUISITE - GE0441      General Geology

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**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course: is to familiarize students with the Earth's relief in relation to its morphology, genesis, age and development, as well as understanding the relationship of modern and buried relief with loose deposits, knowledge of the characteristics of Quaternary deposits, their genetic and stratigraphic classifications, methods of study and mapping.

Course objective:

- obtaining knowledge on the classification of relief and the role of relief-forming factors in its origin;
- assimilation of techniques and methods for a comprehensive study of the relief, identification of geomorphological complexes, their relationships with each other, geological structure and loose deposits;
- familiarization with the main features of the geomorphology and geology of the Quaternary deposits of Kazakhstan;
- acquisition of techniques and methods for compiling geomorphological maps and maps of Quaternary deposits, their analysis with a forecast of further development of the relief and localization of minerals.

**BRIEF DESCRIPTION OF THE COURSE**

Geomorphology is a science that studies the forms of the earth's surface (relief) in relation to their general appearance, size, origin (genesis) and age. Relief formation is conditioned by many variables: conditions, factors and processes developing in time and space. Relief formation manifested itself most clearly in the Neogene-Quaternary time, the so-called neotectonic stage of the Earth's development, which studies the geology of the Anthropogen. The close connection and interdependence of landforms, continental deposits and the conditions in which they are formed determines the need to consider these issues simultaneously in one course. Knowledge of the regularities and features of relief formation makes it possible to carry out a forecast and search for minerals.

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students must

1) know:

- classification of relief and the role of relief-forming factors in its origin;
- methods of comprehensive study of the relief, identification of geomorphological complexes, their relationships with each other, geological structure and loose deposits;

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2) be able to:

- to make a structural-geomorphological analysis of landforms;
- using the knowledge of the basics of neotectonics, describe the stages of the development of the relief;
- compile geomorphological maps, profiles, columns of Quaternary deposits, correlate them and compile elementary maps of Quaternary deposits;
- describe the content of medium-scale geomorphological maps and geological maps of Quaternary deposits;
- decipher the terrain on aerial photographs and topographic maps.

3) master the skills:

- conducting a comprehensive analysis of natural landforms,
- construction of geological and topographic profiles and presentation of the results of work in text and graphic form; geological sections and topographic profiles; geomorphological maps and profiles;
- studies of natural landforms.

**Computer modeling of oil and gas fields**

THE CODE - GEO 460

CREDIT - 8 (2/0/1/2)

PREREQUISITE – GEO 493 Oil and gas geology

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**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course: to provide initial training of students by specification of knowledge in relation to the field of informatization of Oil and gas geology.

Course objective:

acquisition by students of the necessary knowledge about the principles of creating geological models; gaining skills in solving practical and theoretical problems in creating three-dimensional computer models; formation of skills for the optimal and rational use of modern technologies for the interpretation and preparation of initial field information and its use in creating 3D models; application of acquired knowledge, skills and abilities in subsequent professional activities; teach students to choose a software shell in accordance with the task; study of special methods of computer design; study of the features of specialized programs.

**BRIEF DESCRIPTION OF THE COURSE**

Types and technology of building geological models. The dimensions of the models. Comparative characteristics of full-scale and operational geological models. The composition of the primary data for building the model. Methods for checking the completeness and reliability of the initial data and simulation results. Technology for constructing a structural model. Facies model construction technology. Mechanical and hydrodynamic properties of porous media and reservoir fluids. Two-phase flow of liquids in a water-oil reservoir.

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students must

1) know:

stages of construction of permanent geological and technological models; theoretical foundations of algorithms for calculating the geological and filtration model; methods of computer construction of maps; composition and capabilities of various software products used in the oil industry for geological and filtration modeling.

2) be able to:

analyze the geological and field database for completeness and reliability, build a structural frame, build a structural map along the top and bottom of the reservoir and layers, maps of the total thickness, maps of distributed geological and geophysical parameters of the reservoir; substantiate oil-water contact in the model; own the method of computer calculation of reserves.

3) master the skills:

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the ability to load data to calculate the filtration model, adapt the model according to the history of development, analyze the development based on the obtained field distribution maps

## **Fundamentals of geotectonics**

THE CODE - GEO 455

CREDIT - 8 (2/0/1/2)

PREREQUISITE – GEO 432 Structural geology

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### **PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course: the assimilation by students of knowledge on the features of the structure and development of tectonic structures of various ranks; the deep structure of the Earth and the evolution of the structure of lithospheric plates; study of cause-and-effect relationships of tectonic processes occurring in the bowels of the planet with the structure of the earth's crust and upper mantle.

The objective of the course: the study of the causes, features of manifestation, direction of action

tectonic movements in the section of the upper solid shells of the Earth - in the earth's crust and lithospheric mantle, as well as the identification of the time and sequence of initiation, development and stabilization of tectonic structures of the earth's crust of various ranks (structural elements of the earth's crust), formed as a result of tectonic stresses and in various tectonic regimes .

### **BRIEF DESCRIPTION OF THE COURSE**

Branch of geology that studies the structure, movement and deformation of the lithosphere, and its development in connection with the development of the Earth as a whole. Geodynamics is a new scientific discipline that establishes and investigates the forces that generate processes that change the composition and structure of the shells of the solid Earth. Its main method is modeling: mathematical and physical. Geotectonics in solving the most general issues - the causes of tectonic movements, deformations and the development of the structure of the lithosphere as a whole, merges with geodynamics, since it is the latter that studies the forces acting on the scale of the entire globe.

### **KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students must

1) know:

- tectonic terminology; causes and patterns of tectonic movements;
- methods of geotectonics (structural analysis, comparative geotectonics, thickness analysis, analysis of breaks and unconformities, volumetric analysis, paleotectonic analysis, study of modern and neotectonic movements, physical and mathematical modeling, and others);
- methods and specifics of studying tectonic movements of the geological past and present;

- the concept of lithospheric plate tectonics and other hypotheses of the formation of the Earth in general and the earth's crust in particular;
  - eras of mountain building and tectogenesis in the history of the Earth;
  - cyclicity of tectonic processes;
  - tectonic criteria for prospecting for mineral deposits;
- 2) be able to:
- compile various types of tectonic maps and profiles, other models of tectonic structures, including 3 and 4D models;
  - to determine the relative age of tectonic faults;
  - to determine the amplitude and direction of tectonic movements, the time of their manifestation and the duration of movements;
  - determine tectonic criteria for predicting mineral deposits
- 3) master the skills:
- using the principles of tectonic zoning;
  - application of geotectonic research methods.

## **Geological basis of oil and gas fields development**

THE CODE - GEO 450

CREDIT - 8 (2/0/1/2)

PREREQUISITE – GEO 493 Oil and gas geology

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### **PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course: to provide complete information about the object of research, in search of patterns that combine the observed disparate facts about the structure and functioning of the reservoir into a single whole, in the development of rules for the rational conduct of research, in the creation of methods for processing, summarizing and analyzing the results of observations and research, in evaluating the effectiveness these methods in different geological conditions to carry out a rational system for the development of oil and gas fields.

Course objective:

- master the geological foundations of designing the development of oil deposits;
- to study the modes of exploitation of deposits and the oil recovery associated with them .

### **BRIEF DESCRIPTION OF THE COURSE**

Development, testing of wells, geological field and hydrodynamic studies. Trial operation. Basic provisions and tasks of development. Putting oil and gas fields into development. Allocation of operational facilities, development floors. System of development of oil fields, geological and field control of oil recovery in the process of development. Geological factors. Technological factors. Development stages. Rational development system. Development pace analysis. New reservoir stimulation methods for enhanced oil recovery .

### **KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students must

1) know:

- methods of studying wells and reservoirs;
- reservoir properties of rocks;

2) be able to:

- determine the operating modes of the well;
- to analyze the field development;

3) master the skills:

obtaining processing, analysis and generalization of geological, geophysical and technical information.

**Methods for laboratory study of organic matter, oil and gas**

THE CODE - GEO 624

CREDIT - 7 (2/0/1/2)

PREREQUISITE – GEO 493 Petroleum Geology

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**PURPOSE AND OBJECTIVES OF THE COURSE**

The purpose of the course: to familiarize and understand students of the theoretical foundations of geochemical methods, on the basis of which the choice and application of the most rational method for prospecting and discovering mineral deposits depending on specific geological and landscape-geochemical conditions, as well as acquiring practical skills in interpreting and processing geochemical data can be made.

Course objective:

- formation of students' ideas about the geochemical foundations of prospecting, geochemical prospecting signs of deposits and methods of geochemical prospecting;
- mastering methods for assessing the conditions of migration and concentration of chemical elements, identifying geochemical barriers;
- study of geochemical classifications of chemical elements according to various characteristics;
- mastering the methods of isotope geochemistry;
- analysis of geochemical maps using GIS technologies;
- mastering the methodology of geochemical searches in various landscape and climatic zones;
- carrying out the calculation of geochemical resources of the subsoil of the territories.

**BRIEF DESCRIPTION OF THE COURSE**

Laboratory methods for searching for mineral deposits are based on the study of the patterns of distribution of elements and their compounds found in natural conditions. Easily discoverable deposits have been discovered, therefore, the prospects for discovering new objects are associated with the fund of “hard-to-discover deposits”, which include deposits: covered by loose deposits; primary and secondary ore minerals, the ore bodies of which are visually indistinguishable from the host rocks. Detection of just such types of deposits is carried out by geochemical methods of prospecting.

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

As a result of mastering the discipline, students should

4) know:

- theoretical foundations of geochemical methods for prospecting for mineral deposits,
- forms of finding elements in the earth's crust,

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- general concepts of geochemical anomalies,
- the main patterns of migration of elements in the earth's crust,
- internal and external factors of element migration,
- general patterns of formation of secondary lithochemical scattering halos, their parameters,
- types of geochemical methods for prospecting for mineral deposits

5) be able to:

- based on the theoretical foundations of geochemical methods, it selects the most rational method of prospecting for the discovery of deposits of solid minerals, depending on specific geological and landscape-geochemical conditions.

6) master the skills:

- students will acquire teamwork skills when discussing the plan of work on sections of the course program, during the preparation and public defense of materials in the form of reports and presentations,
- learn the rules of active and constructive listening, openness, feedback.
- interpretation of geochemical data.

**Innovation methods of geological exploration**

CODE - GEO 609

CREDIT - 7 (2/0/1/2)

PREREQUISITE – GEO 436 Geoinformation technologies in geology

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**PURPOSE AND OBJECTIVES OF THE COURSE**

As part of the course, the student will master the practical application and methods of three-dimensional modeling in geological exploration using the Micromine software. This requires a modern geologist to have knowledge not only of geology and metallogeny, but also in the field of GIS.

**BRIEF DESCRIPTION OF THE COURSE**

The course is intended for students of specialty 6B07202. This course covers the main issues related to geographic information systems: GIS provisioning, map projections, thematic cartography, GIS functionality, and some technologies for creating digital maps. In this course, students will master computer literacy in relation to solving geological problems using modern programs MapInfo , Micromine.

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

The student should be able to: Work with a geological database, create and visualize field data; Bind bitmaps; Create wireframe and block models of ore bodies.

Upon completion of the course, the student should know: GIS Micromine in relation to solving geological problems, be able to interpret geological data and be able to process. To reason and think analytically and critically; evaluate your actions.

**Microscopic studies of minerals and rocks**

CODE - GEO 604

CREDIT - 8 (2/0/2/2)

PREREQUISITE – GEO 196 Crystallography and mineralogy

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**PURPOSE AND OBJECTIVES OF THE COURSE**

Acquisition of knowledge about the methods of studying petrographic minerals that form rocks using a polarizing microscope, and the practice of writing petrographic descriptions.

**BRIEF DESCRIPTION OF THE COURSE**

As a result of studying the discipline, students must master the basics of the crystal-optical method, the ability and skills to determine the mineral composition and structure of rocks using a polarizing microscope, and make their petrographic description. Crystal optics is a branch of physics that studies the laws governing the propagation of light waves in solid media. It is the basis of the microscopic method for studying minerals and rocks.

Using a microscope, one can examine the structure of rocks, the mineral composition, their shape and size, changes in minerals and other features. This is especially true for rocks, most of which have a microgranular structure and it is not always possible to study macroscopically. In addition, it should be noted that examination under a microscope is a fairly cheap and fast method for determining minerals and rocks.

**KNOWLEDGE, SKILLS AFTER COMPLETING THE COURSE**

- teach students to work with a polarizing microscope;
- know the basics of the crystal-optical method for studying minerals in thin sections;
- determine the mineral composition and structure of rocks;
- identify types and varieties of rocks

**Petrography of sedimentary rocks of oil and gas bearing regions of Kazakhstan**

THE CODE - GEO 625

CREDIT - 8 (2/0/2/2)

PREREQUISITE – GEO493 Oil and gas geology

GEO434 Petrography

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**PURPOSE AND OBJECTIVES OF THE COURSE**

Obtaining knowledge about the theoretical foundations of forecasting oil and gas potential subsoil, lithosphere for the installation and planning of prospecting and exploration geological factors and factors controlling the placement of oil and gas fields know the basic rules.

The main tasks of prospecting and exploration work and methods for their solution concept;

**BRIEF DESCRIPTION OF THE COURSE**

Petrography of sedimentary rocks is a descriptive part of lithology, studying solving the problems of classification of sedimentary rocks, their chemical and mineral composition, structural and textural features.

The doctrine of geological formations is a major section of lithology, considered - digging geological systems of various hierarchical ( superrock )the level of organization of a substance, which considers the composition, structure, forms allocation, position in the structures of the earth's crust, formation environment, mineragenic specialization of these systems.

The student must be able to:

- identify minerals by their physical properties that occur in nature; – to determine mineral grains and aggregates by their morphological features, appearance or habit;
- use paragenetic associations of minerals for the diagnosis of minerals; - to distinguish the minerals that make up the rock from similar minerals and analyze mineral associations;
- to determine the main types of rocks by external signs, to describe the composition, structure and texture of rocks.

know:

- theoretical foundations of crystallography and general geology; – tasks and methods for studying igneous, sedimentary, metamorphic and metasomatic rocks; – morphological types of mineral aggregates and master the methods of visual diagnostics of minerals

**Defense of the thesis/thesis project**

CODE - ECA102

CREDIT - 4

The purpose of the thesis (project) is:

- 1) systematization, consolidation and expansion of theoretical knowledge and practical skills in the specialty and their application in solving specific scientific, technical, economic and industrial problems, as well as cultural purposes;
- 2) development of skills for conducting independent work and mastering the methodology of scientific research and experimentation in solving the developed problems and issues;
- 3) finding out the student's preparedness for independent work in the conditions of modern production, science, technology, culture, as well as the level of his professional competence.

**SHORT DESCRIPTION**

The procedure for defending a thesis (project) is determined by the Rules for conducting ongoing monitoring of academic performance, intermediate and final state certification of students in educational institutions, approved by orders of the Ministry of Education and Science of the Republic of Kazakhstan. The thesis (project) is defended at an open meeting of the state attestation commission with the participation of at least half of its members. The defense of the thesis (project) is organized in a public form, with the presence of students, teachers of the graduating department. The supervisor, representatives of the organization on the basis of which the thesis research was conducted and other interested persons can also be invited to the defense. The duration of the defense of one thesis, as a rule, should not exceed 30 minutes per student. To defend the thesis, the student makes a presentation to the state attestation commission and those present for no more than 15 minutes. All those present in the form of questions or speeches can take part in the discussion of the thesis (project). After the discussion, the secretary of the commission reads out a review (if present, the supervisor can speak in person) and a review. If there are comments in the review and / or review, the student must give a reasoned explanation of their essence. Based on the results of defending the thesis (project), an assessment is made according to the point-rating letter system. This takes into account the level of theoretical, scientific and practical training, the review of the supervisor and the assessment of the reviewer. The results of the thesis defense are recorded in the minutes of the meeting of the state attestation commission individually for each student and are announced

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