

NON-PROFIT JOINT-STOCK COMPANY
«KARAGANDA TECHNICAL UNIVERSITY NAMED AFTER ABYLKAS
SAGINOV»

Academic Council

protocol № 11

« 30 » 04 2025 year



PROGRAM
THE ENTRANCE EXAM
for admission to the doctoral program in the educational program
8D07202 – «Mining»

Department: Development of mineral deposits

Compiled by:

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The program of the entrance exam for the educational program 8D07202 – «Mining» has been developed::

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Discussed at the meeting of the DMD Department

Protocol № _____ «____» _____ 2025 .

Head of the Department DMD

_____ Imashev A.Zh.)
(signature)

The main topics submitted for the entrance exams

1. «Organization of scientific research and innovation activities»

1.1. General information about scientific research (Research work)

Classification of research and development according to various criteria: types of links with production, degree of importance, sources of financing, duration of development, purpose, etc.

Stages of the process of performing theoretical and applied research: formulation of the topic, goals and objectives of the study, theoretical and experimental research, analysis and design of scientific research, implementation and economic efficiency

Scientific institutions and training of scientific personnel. The National Academy of Sciences and academic institutes, branch institutes, universities. Master's, postgraduate and doctoral studies.

The role of scientific and technical information in the formulation of research topics. Media. Information flows. Information storage. The main methods and methods of information retrieval. Sources of information. Conditions for effective document processing. Work on the book. Extracts, abstracts, summaries and reviews. Conclusions based on the analysis of information.

1.2. Theory and practice of the experiment

Methodology of theoretical research: deduction and induction, analysis and synthesis, ranking, abstraction and formalization.

Classical methods of studying functions at the extremum.

Linear programming: problem statement, graphical solution method, distributive method. Transport task: task formation, open and closed tasks, methods of finding a basic solution, the method of potentials. Integer linear programming problems. Application of linear programming methods in mining.

General concepts of nonlinear programming: economic and geometric interpretation of nonlinear programming problems, convex programming problems, gradient solution methods.

General concepts of dynamic programming: general characteristics of tasks, their economic and geometric interpretation, methods of step-by-step problem solving, the principle of optimality.

The methodology of the experiment. Development of an experimental plan-program. Measuring instruments. The main provisions of the theory of

experiment planning, justification of the necessary and sufficient number of repetitions of the experiment.

Processing of measurement results: fundamentals of mathematical statistics, theoretical and statistical distributions of random variables, histogram, polygon, confidence interval and confidence probability.

Selection of empirical dependencies by methods: stretched thread, average, least squares.

1.3. General information about the theory of innovation

The general scheme of development of technical systems. The connection of cyclical processes of the economy with the development of technology and technology. The main provisions of the theory of long waves. General characteristics of innovation processes: technical and technological innovations, organizational, managerial and economic innovations, social, legal and environmental innovations. Innovative processes in enterprises. Evaluation of the effectiveness of innovations.

1.4. Recommended literature

1 Ludchenko A.A., Ludchenko Ya.A., Primak T.A. Fundamentals of scientific research: textbook. stipend / Edited by A.A. Ludchenko. – 2nd ed., revised. – Kiev: O-vo "Knowledge", KOO, 2001. – 113 p.

2 Scientific problems of mining production: collection of articles / Edited by V.V. Istomin. – M.: MGSU, 2000. – 355 p.

3 Wentzel E. S. Probability theory. – M.: ACADEMIA, 2003. – 572 p.

4 Hemdi A. Taha Introduction to operations Research - Operations Research: An Introduction. — M.: Williams, 2007. — 912 p.

5 Grachev Yu.P. and Plaksin Yu.M. Mathematical methods of experiment planning. – M.: Higher. education, 2005. – 296 p.

6 Aleksakhin S.V. Applied statistical analysis: a textbook for universities. – M.: PRIOR, 2001. – 224 p.

7 Blinnikov V.I. Patent: from idea to profit. – M.: Mir, 2002. – 333 p.

2. «Practical geomechanics»

2.1. Basic concepts of mountain pressure

Mountain pressure. The manifestation of mountain pressure. Displacements of the rock mass. Discharge zones and stress concentrations. Forms of manifestation of mountain pressure. Mountain pressure control. Classification of ores and rocks according to the degree of stability. The main properties of the array and its model. Fracturing of the array. Uniformity and heterogeneity of the array.

2.2. The natural stress state of the rock mass

Horizontal and vertical stresses in the array. The coefficient of lateral pressure. Gravitational stress state. Horizontal tectonic stress state. Hydrostatic stress state. The stress state and displacement of the array around the workings. Forms of destruction of mine workings. The basic principles of ensuring the sustainability of workings. Categories of rock stability.

2.3. Fixing of preparatory workings

The main types of support. Shotcrete is a concrete support. Anchorage. Metal frame support. Combined support. Choosing the type of support. Foreign experience in assessing the stability of workings and choosing the type of support. Rating classifications of the rock mass.

2.4. Mountain Bumps

Basic concepts and definitions. Dynamic manifestations of mountain pressure. Conditions of occurrence of fire-hazardous situations. The forecast of the impact hazard of sections of the rock mass. Measures to reduce the impact hazard of workings.

2.5. Mountain pressure management

Management of rock pressure in the development of shallow and inclined deposits. The principle of mountain pressure control. Principles of determining the load on the targets. The stressed state and strength of the tselikov. Management of rock pressure during the re-development of shallow deposits. Maintenance of the developed space by ore columns.

2.6. Recommended literature

1. Baklashov I.V. Geomechanics: textbook for universities / in 2 vols. Fundamentals of geomechanics. – M.: MGGI Publishing House, 2004. - Vol. 1. - 208 p.
2. Protosenya A.G., Timofeev O.V. Geomechanics. - St. Petersburg: St. Petersburg State Mining Institute, 2008. - 117 p.
3. Baklashov I.V., Kartoziya B.A., Shashenko A.N., Barisov V.N. Geomechanics: textbook for universities / in 2 volumes. Geomechanical processes. – M.: Publishing House of MGGI, 2004. - Vol. 2. – 249 p.
4. Makarov A.B. Practical geomechanics: a manual for mining engineers. – M.: Publishing house "Gornaya kniga", 2006. - 391 p.
5. Olovyanney A.G. Some problems of mechanics of rock masses. – St. Petersburg: FSUE "Multiplying Scientific Center" VNIMI, 2003. - 234 p.
6. Kazikaev D.M. Geomechanics of underground ore mining. - M.: Publishing House of Moscow State University, 2005. - 542 p.
7. Pevsner M.E., Iosif M.A., Popov V.N. Geomechanics. – M.: Publishing House of Moscow State University, 2008. – 438 p.

8. Hoek E. Practical Rock Engineering. – Vancouver, 2007. – 237 p.
9. Tsai B.N. Thermal activation nature of rock strength. -Karaganda: KarSTU, 2007. – 235 p.
10. Brady B.H., Brown E.T. Rock mechanics for underground mining. – Dordrecht.: Springer, 2005. – 628 p.
11. Trushko V.L., Protosenya A.G., Matveev P.F., Sovmen H.M. Geomechanics of massifs and dynamics of deep mine workings. - St. Petersburg: St. Petersburg Mining Institute, 2000. - 396 p.

3. «Modern problems in mining»

3.1. Combined geotechnology

The essence and current state of the combined technology. Conditions of application and design of the combined technology. Development of reserves of transition zones with combined technology. Substantiation of the main parameters of the combined technology. The main problems of effective application and development of combined technology. Evaluation of the effectiveness and justification of the field of rational use of combined technology.

3.2. Problems of development of mineral deposits

New promising technologies in the complex development of ore deposits. Re-development of deposits. Formation of the basic principles for the creation of low-waste technologies. Studies of the interaction of man-made spaces created with an array of rocks. Development systems that ensure the completeness of the extraction of mineral reserves. The influence of the main mining and geological and mining engineering conditions of development on the stability of man-made spaces.

3.3. Modern problems of geomechanics and rock destruction

The main provisions and the history of the development of geomechanics. Priority and new scientific directions in geomechanics. Objects and tasks of geomechanics research. Modern problems in the field of rock destruction. The development of scientific knowledge and practice in the field of rock destruction. The object of research and tasks in the field of rock destruction.

3.4. Modern problems and prospects of mining production

Modern problems of underground mining. Modern problems of open-pit mining. Modern problems of maintaining mine workings. Problems of mine ventilation and ensuring the safety of mining operations. Training of personnel for mining enterprises. Geoinformation systems in mining. Problems of numerical modeling of geomechanical processes.

3.5. Recommended literature

1. Combined geotechnology / D.R. Kaplunov, V.N. Kalmykov, M.V. Rylnikova. – M. : Ore and metals, 2003. – 260 p.
2. Geotechnological methods of field development / L.A. Puchkov, I.I. Sharovar, V.G. Vitkalov. – M.: Gornaya kniga, 2006. – 322 p.
3. Lazchenko K.N. Geotechnological methods of mining mineral deposits: a textbook / K.N. Lazchenko. – M.: Publishing House of Moscow State University, 2007. – 244 p.
4. Complex development of natural and man-made mineral resources. Monograph / B.T. Berkaliev, B.J. Khamimolda, R.K. Komarov. – Karaganda: 2007. – 160 p.
5. Andreiko S.S. Modern problems of science and production in the field of mining: studies. stipend. – Perm: Publishing House of Perm State Technical University. unita, 2010. – 338 p.

Essay Topics (10 topics)

\$\$\$001

Problems of geotechnology development at the stage of revision with systems with open production space

\$\$\$002

Your vision of a digital mine

\$\$\$003

Prospects for the development of drilling and blasting operations in the digital mine system?

\$\$\$004

Your idea of the possibility of expanding the scope of roof bolting

\$\$\$005

Your idea of the manifestations of rock pressure during the development and operation of development workings

\$\$\$006

Your idea of rock mass rating classifications

\$\$\$007

Suggest the best option for the transportation of rock mass during open pit mining

\$\$\$008

Your idea of modeling in mining

\$\$\$009

Feasibility of switching from open pit mining to underground development of the field

\$\$\$010

Is it possible to gain knowledge only by summarizing practical experience in production?