NON-PROFIT JOINT STOCK COMPANY
ABYLKAS SAGINOV KARAGANDA TECHNICAL UNIVERSITY

THE PROGRAM
OF ENTRANCE EXAM
for admission to doctoral studies
Educational program 8D07206 – "Mine surveying"

Department: Mine surveying and geodesy

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Introduction

The main objectives of training doctoral students in the educational program 8D07206 "Mine Surveying" are: training postgraduate education specialists with a high level of professionalism, a culture of professional communication, having a civic position, capable of formulating and practically solving modern practical problems in the field of surveying.

Database of examination materials for entrance exams to doctoral studies in the educational program 8D07206 "Mine Surveying" for the 2024-2025 academic year:

Structure and content of the exam according to the profile of the group of educational programs

1. The electronic examination ticket consists of 3 questions:

Blocks	Nature of the question	Number of points
1st question	theoretical - determines the level and consistency of theoretical knowledge	10
2nd question	practical - reveals the degree of formation of functional competencies (the ability to apply methods, technologies and techniques in the subject area)	15
3rd question	reveals a systematic understanding of the subject area being studied, specialized knowledge in the field of research methodology (systemic competencies)	25
TOTAL		50

2 Materials for entrance exams

2.1 Questions for the first block –
50 - for state educational programs in natural and technical areas

1. What work does a surveyor perform at a mining enterprise?
2. What issues does surveying study, the content of surveying work?
3. Surveying measurements, instruments and methods.
4. History of the development of surveying department.
5. Surveying graphic documentation. Composition, types and content.
6. Surveying support and survey networks.
7. Topographic surveys of the surface of the mining allotment.
8. Taking projects into production. Methods and means
9. Geometrization of mineral deposits. Essence, tasks, stages

10. Geometrization of mineral deposits. Modern software tools
11. Geometrization of faults. Elements and parameters.
12. Geometrization of fold faults. Elements and parameters.
13. Methods for studying and analyzing fracturing. Software "Dips"
14. General information about the qualitative properties of minerals.
15. Information from mathematical statistics in connection with the geometrization of the properties of minerals
16. Methods for processing the results of surveying measurements
17. Basic laws of distribution of random variables used in surveying
18. Point and interval evaluation of measurement results
19. Graph of changes in component content by production. Construction and smoothing.
20. Accounting for movement and loss of inventory. Basic methods.
21. Methods for calculating reserves.
22. Types of losses and dilution of mineral resources and their classification.
23. Methods for determining and accounting for losses and dilution of mineral resources.
24. Determination of the volume of minerals in warehouses and overburden of dumps.
25. Surveyor control over operational accounting of production and stripping.
26. Accounting for the condition and movement of reserves at mining enterprises.
27. Surveying work during underground mining
28. Surveying work during open-pit mining
29. Horizontal connecting surveys (orientation)
30. Orientation through the adit shaft
31. Geometric orientation through one vertical trunk
32. Orientation through two vertical trunks
33. Orientation of subfloor horizons
34. Vertical connecting survey
35. Assignment and direction to mining workings. Horizontal and vertical plane
36. Mine surveying work when carrying out mining workings with counter faces
37. Shooting of cut and stop mine workings
38. Surveyor measurements of underground mine workings
39. Measurements using a laser scanner
40. Methods for creating and developing filming networks in quarries
41. Methods of surveying surveys in quarries
42. Surveying support for drilling and blasting operations
43. Surveying work during trenching
44. Mine surveying maintenance of intra-quarry highways
45. MFarkshading service of intra-quarry railway tracks
46. Surveying services for conveyor transport.
47. Methods for determining the volume of excavated rock mass in quarries

48. Determination of the coefficient of loosening of rock mass
49. Mine surveying work during dumping
50. Surveying work during land reclamation

Recommended reading
1. Borshch-Komponiets V.I., Navitny A.M., Knysh G.M. Marshader business. Textbook - 3rd ed., revised and supplemented. - M.: Nedra, 1992. - 447 p.

2.2 Questions on the second block –
50 - for state educational programs in natural and technical areas

1. Surveying work to ensure the stability of slopes in quarries
2. Geomechanical monitoring system. General information
3. Development of the design of observation stations
4. Existing monitoring methods in surveying
5. Monitoring the state of on-board arrays using a total station
6. Monitoring the state of on-board arrays using GNSS technologies
7. Combined monitoring methods
8. Monitoring the state of near-bottom arrays using UAVs
9. Monitoring the state of near-bottom arrays using terrestrial laser scanning
10. Monitoring the state of near-bottom arrays using radar interferometry
11. Monitoring the state of near-bottom arrays using remote sensing
12. Monitoring the condition of near-bottom arrays using leveling
13. Monitoring the condition of near-bottom arrays using extensometers
14. Analysis of survey monitoring results
15. Criteria for assessing the condition of near-board arrays
16. Automated methods for monitoring the stability status of on-board arrays
17. Calculation of safety factors for quarry slopes
18. Mathematical modeling of edge massifs for calculating the stability of quarry slopes
19. Justification and selection of a geomechanical model when assessing the stability of quarry slopes
20. Forms of violation of the stability of quarry slopes
21. Calculation of the stability of a homogeneous slope
22. Calculation of the stability of a slope with a corresponding weakening surface
23. Calculation of slope stability with wedges falling out. Simulation in Swedge Software
24. Landslide reverse calculation method
25. Construction of quarry slopes
26. Zoning of a quarry field according to the sustainability factor
27. Surveying work during the construction of mines
28. Creation of a alignment network on the mine surface

29. Layout of buildings, structures and transport communications
30. Layout and survey control during installation of the lifting complex
31. Mine surveying work when sinking and securing vertical shafts
32. Mine surveying work when cutting and carrying out near-shaft workings
33. Mine surveying work when carrying out capital mine workings with a large cross-sectional area
34. Rock movement. General information
35. Basic parameters characterizing the process of rock displacement
36. The main factors determining the process of rock movement
37. Surveying instrumental observations of rock movement
38. Conditions for the safe working of buildings and structures and measures for their protection
39. Open-pit mining systems
40. Classification and main elements
41. Open pit mining of deposits
42. Classification of opening methods
43. Cyclic flow technology in quarries and prospects for its application
44. Systems for developing ore deposits using the underground method
45. Classification of ore deposit development systems
46. Development systems with open treatment space
47. Continuous development systems
48. Room and pillar systems
49. Development systems with sublevel excavation
50. Development systems with ore storage

Recommended reading

1. Sinanyan R.R. Surveying business. Textbook – 2nd ed., revised and supplemented. - M.: Nedra, 1988. - 311 p.
2. Surveying business. Edited by prof. V.N. Guseva / St. Petersburg: National Mineral Resources University "Mining", 2014– 402 p.
3. Analysis of the accuracy of underground surveying networks. / Zverevich V.V. Gusev

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"Mountain", St. Petersburg, 2014. 2nd edition corrected. 146 p.

2.3 Questions on the third block
 50 - for state educational programs in natural and technical areas

1. Development systems in horizontal layers with backfill
2. Development systems with the collapse of host rocks
3. Repeated training. Removing pillars
4. Determination of the location of mine shafts and capital mine workings

5. Rocks as an object of development. mountain range
6. Physical and mechanical characteristics of rocks
7. Fundamentals of the theory of stress-strain state. Determination of stresses
8. Fundamentals of the theory of stress-strain state. Determination of deformations
9. Fundamentals of stress theory. Determination of stresses on inclined platforms. Problem 1D
10. Fundamentals of stress theory. Constructing a circular Mohr stress diagram
11. Relationship between stress components and strain components for a linear elastic body. Hooke's law
12. Elastic constants of the material. Young's modulus. Poisson's ratio.
13. Fundamentals of stress theory. Problem 2D. The concept of stress at a point
14. Fundamentals of stress theory. 3D task. The concept of stress at a point
15. Fundamentals of stress theory. 3D task. Components and stress tensor.
16. Fundamentals of stress theory. 3D task. Calculation of stresses when turning axes.
17. Fundamentals of stress theory. 3D task. Main stresses and main areas.
18. Fundamentals of stress theory. 3D task. Invariants of the stress tensor. Cubic equation.
19. Fundamentals of stress theory. 3D task. The highest tangential stresses.
20. Fundamentals of stress theory. 3D task. Octasdrical stresses.
21. Fundamentals of stress theory. 3D task. Spherical tensor and stress deviator tensor.
22. Fundamentals of the theory of deformations. Problem 2D. The concept of a deformed state at a point
23. Fundamentals of the theory of deformations. 3D task. Designation of deformation components. Strain tensor
24. Fundamentals of the theory of deformations. 3D task. Components of deformation in arbitrary directions
25. Fundamentals of the theory of deformations. 3D task. Principal deformations and principal axes
26. Fundamentals of the theory of deformations. 3D task. The spherical tensor and the deformation deviator tensor.
27. Relationship between stress and strain components for a linear elastic body. Generalized 3D Hooke's law
28. Specific potential energy. Elastic potential at a point.
29. Differential ratios of stress-strain state components in a continuous medium
30. Relationship between stress and strain components for a nonlinear body
31. Rheological processes in rocks. The simplest rheological models.
32. Hypotheses (theories) of rock strength. Classification of strength theories.
33. Strength of fractured rock mass.
34. Crack strength. Barton's equation
35. Concept of structural weakening coefficient

36. Determination of the strength of an array based on theory and Coulomb–Mohr
37. Determination of the strength of an array based on theory and Hooke–Brown
38. Ratings and classifications of rock masses
39. Rating classification by D. Lobshir
40. RQD breed quality indicator
41. Rating classification RMR (by Bieniawsky) 1976
42. Rating classification RMR (by Bieniawsky) 1989
43. Barton classification (Q - system)
44. Comparison of Q and RMR classifications
45. Rock pressure. Natural stress state of the massif.
46. Rock pressure. Gravitational stresses. The theory of AN Dinik.
47. Rock pressure. Tectonic stresses. Project .
48. Rock pressure. Methods for assessing the natural stress field in a massif.
49. Rock pressure. Voltage measurement. Unloading method.
50. Rock pressure and its manifestations in underground workings

Recommended reading

1. Popov V.N. Geodesy and surveying. Textbook - 2nd ed., erased. - M.: Mining Book; M.: Publishing house of Moscow State University, 2007. - 452 pp.
2. Surveying business. Edited by prof. V.N. Guseva / St. Petersburg: National Mineral Resources University "Mining", 2014– 402 p.
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3 Essay topics

$$$001
Geographic information systems (GIS) and their application in surveying
$$$002
Surveying support for underground mining: problems and solutions
$$$003
Mine surveying support for open-pit mining: innovation and process optimization
$$$004
Automation and robotization in surveying: present and future
$$$005
Analysis of the accuracy of surveying measurements and methods for increasing it
$$$006
The use of unmanned aerial vehicles (UAVs) in surveying
$$$007
Methods for predicting deformations of the earth's surface during mining

$$$008

Satellite technologies in surveying: opportunities and limitations

$$$009

The use of laser scanning in surveying work

$$$010

 Future development of surveying department

4 Recommended reading

1. Borshch-Komponiets V.I., Navitny A.M., Knysh G.M. Marshader business. Textbook - 3rd ed., revised and supplemented. - M.: Nedra, 1992. - 447 p.
2. Sinanyan R.R. Surveying business. Textbook – 2nd ed., revised and supplemented. - M.: Nedra, 1988. - 311 p.
3. Popov V.N. Geodesy and surveying. Textbook - 2nd ed., erased. - M.: Mining Book; M.: Publishing house of Moscow State University, 2007. - 452 pp.
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