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Disciplines are studied as part of the Higher Educational Programme "Mining geology"
in the Higher Education Field 05.04.01 Geology

Federal State Autonomous Educational Institution for Higher Education
PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA
(RUDN University)

COURSE DESCRIPTION

The study of disciplines is carried out as part of the Higher Education Programme of Higher Education (HEP HE):

Mining geology

(name (profile/specialization) of the Higher Education Program)

implemented in the Higher Education Field:

05.04.01 Geology

code and name of the Higher Education Field

Disciplines are studied as part of the Higher Educational Programme "Mining geology"
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Course Title	Russian as a Foreign Language
Course Workload (credits / academic hours)	6/216
Course contents	
Course Module Title	Brief Description of the Module Content
Module 1. Institute of Science and Technology (Foreign countries)	Topic 1.1. The specifics of the functioning of the Institute of Science and Technology in foreign-speaking countries and in Russia. The ability to compare this knowledge in communication.
Module 2. Specialized culture	Topic 2.1. Rules and norms of communication in the professional scientific and technical sphere in foreign-speaking countries and in Russia
Module 3. Reports	Topic 3.1. Formation of the ability to understand oral presentations / long speeches in a foreign language on engineering topics.
Module 4. Articles	Topic 4.1. Written foreign-language general scientific / highly specialized articles in the field of engineering.
Module 5. Patents	Topic 5.1. Foreign language patents in the field of engineering.
Module 6. Business Letter	Topic 6.1. Complex argumentation in business foreign-language letters.
Module 7. Prepared conversation	Topic 7.1. The ability to conduct an unprepared conversation on general scientific and highly specialized topics in the field of engineering.
Module 8. Authoritative scientists in the field of engineering (taking into account the direction studied)	Topic 8.1. Famous scientists in the field of science and technology. History and main directions of development of science and technology in foreign-speaking countries, Russia in the field of engineering.
Module 9. Argumentation	Topic 9.1. Logical argumentation in a foreign language. Arguments and counterarguments
Module 10. Discussion	Topic 10.1. Discussions on general scientific and highly specialized issues. Expressing one's own position in a foreign language.
Module 11 Message	Topic 11.1. Message on the proposed general scientific topics in the field of engineering in a foreign language.
Module 12. Presentation of scientific and technical concepts in professionally oriented discourse	Topic 12.1. Scientific and technical concepts in a foreign language and Russian text in the field of engineering
Module 13	Topic 13.1. Composition, motives, pragmatic setting of a foreign scientific text.
Module 14. Abstracting the text	Topic 14.1. Key segments of the text. Receiving the information. Abstract review.
Module 15. Main idea and author's attitude	Topic 15.1. The main idea of the text. Author's attitude to the topic of the text.
Module 16 Abstract	Topic 16.1. Abstracting a foreign language text in the field of engineering. The ability to determine their attitude to the content of the read.
Module 17 Overview	Topic 17.1. An overview outlining developmental achievements in the field of engineering.

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Course Title	Russian as a Foreign Language
Course Workload (credits / academic hours)	6/216
Course contents	
Course Module Title	Brief Description of the Module Content
Module 18. Business conversation	Topic 18.1. Conversation of a professional/scientific/industrial nature

Course Title	Regional Geology. Geology of Central and Southern Africa
Course Workload (credits / academic hours)	4/144
Course contents	
Course Module Title	Brief Description of the Module Content
Section 1. Introduction	1.1. The subject and methods of regional geology, its relationship with other geological disciplines 1.2. The internal structure of the Earth, geotectonic hypotheses (Plate tectonics and plume tectonics) and stages of development of the Earth's crust 1.3. Principles of tectonic zoning. Zoning of continents. Zoning of the oceans. Types of tectonic maps
Section 2. General features of the structure of continental massifs	2.1. The largest structural elements of the continental massifs 2.2. Eurasian, North American, African massifs 2.3. South American, Australian and Antarctic massifs
Section 3. Geology and tectonic structure Africa	3.1. The foundation of the ancient platform 3.2. Sedimentary cover of an ancient platform 3.3. The main stages of the development of the African Platform

Course Title	Digital Technologies in Geology
Course Workload (credits / academic hours)	7/252
Course contents	
Course Module Title	Brief Description of the Module Content
Section 1. General issues of computer processing of geological information	1.1. Sources and types of geological information, formalization of geological data. Computer representation of raster, vector, numeric and text data, file formats, format conversion, converters
Section 2. Specialized computer programs used to solve geological problems	2.1. Graphic and text editors for commercial and free use 2.2. Programs for analyzing and displaying numerical data. Vectorizers. Programs to build maps in isolines, borehole columns. Programs for processing remote sensing data
Section 3. General issues of geoinformatics. Organization and visualization of data in GIS	3.1. Geographic information systems (GIS), areas of application, structure, software and hardware 3.2. Sources and types of data, input and storage of spatially coordinated and attributive data. Vector and raster data, geodatabases
Section 4. Spatially coordinated and attributive data	4.1. Projection, curvilinear and affine transformations, scaling and generalization. Basic operations with raster data (layer displaying, recoding, overlaying, filtering, calculation

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Course Title	Digital Technologies in Geology
Course Workload (credits / academic hours)	7/252
Course contents	
Course Module Title	Brief Description of the Module Content
transformation and analysis in GIS	of slope, aspect ratio, distances, perimeters, areas, buffer zones and visibility zones detection). Basic operations with vector data (mapping, splitting and merging, topographic overlay, buffering, discrete georeferencing (geocoding). Basic operations with attributive data (statistical analysis, plotting, interpolation). Expert systems
Section 5. Applied aspects of geoinformatics	5.1. Requirements for the content of databases. Comparative characteristics of the basic tools and software GIS. Examples of GIS implementation. Prospects and trends in the development of geoinformatics in Russia and abroad.

Course Title	Geological and Geophysical Basics of Mineral Prospecting and Exploration
Course Workload (credits / academic hours)	7/252
Course contents	
Course Module Title	Brief Description of the Module Content
Section 1. Subject, history, main issues	1.1. Subject and objects of research. The place of the discipline in the system of sciences. Relationship of the course with the disciplines of the geological and economic cycles. The history of the development of the doctrine of search and exploration of mineral deposits. The most important concepts and terms
Section 2. Geology of mineral deposits	2.1. Classification of mineral deposits 2.2. Industrial types of metallic mineral deposits. General information about industrial deposits of metallic minerals. The principles of industrial classification of metallic minerals. Examples of classifications. 2.3. Deposits of ferrous, non-ferrous, noble, rare and rare-earth, radioactive (including uranium) metals. The main (industrial) ore minerals. Characteristics of the most important geological and industrial types of deposits. The largest and unique deposits. The scale of mineral reserves. The state of the raw material base, the volume of production of minerals in the world; prices on the world market. 2.4. Deposits of non-metallic minerals. General information about industrial deposits of non-metallic minerals. The principles of industrial classification of non-metallic minerals. Examples of classifications. Chemical and agronomic raw materials. Industrial and stone raw materials. Construction materials. Areas of industrial use. Industry requirements to the quality of raw materials, technological types and varieties of minerals. State of the raw material base, the volume of production in the world and Africa; prices on the world market. Characteristics of the most important geological and industrial types of deposits. 2.5. Uranium deposits in Africa

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Course Title	Geological and Geophysical Basics of Mineral Prospecting and Exploration
Course Workload (credits / academic hours)	7/252
Course contents	
Course Module Title	Brief Description of the Module Content
Section 3. Searching for minerals	<p>3.1. Stages and stages of geological exploration. Modern classification of stages and phases</p> <p>3.2. Searching geological criteria (prerequisites) and signs. Definition of the concept of criterion and trait. The meaning of these terms for search geology. Global and regional criteria. Geological and non-geological attributes.</p> <p>3.3. Search for mineral deposits, including uranium ores. Classification of searches according to the conditions and methods of work. Methods of prospecting (mineralogical, geochemical, geophysical, etc.). Searches of overlapped deposits.</p>

Course Title	Engineering and Geological Support of Subsoil Use
Course Workload (credits / academic hours)	7/252
Course contents	
Course Module Title	Brief Description of the Module Content
Section 1. Fundamentals of engineering geology	<p>1.1. engineering-geological classification of rocks;</p> <p>1.2. structural bonds in rocks;</p> <p>1.3. rocky and semi-rocky rocks: main characteristics and features;</p> <p>1.4. clay rocks: features and main characteristics;</p> <p>1.5. separate-grained rocks: features and main characteristics;</p> <p>1.6. the concept of "soil";</p> <p>1.7. soil classification;</p> <p>1.8. technogenic soils formed at mining enterprises;</p> <p>1.9. permafrost soils.</p>
Section 2. Physical and mechanical properties of rocks	<p>2.1. classification of rock properties;</p> <p>2.2. physical properties of rocks and deposits;</p> <p>2.3. mechanical properties of rocks;</p> <p>2.4. laboratory and field methods for determining the properties of rocks;</p> <p>2.5. processing the results of experimental data, assessing their reliability;</p> <p>2.6. rock strength passport and its main characteristics;</p> <p>2.7. scale factor in assessing the properties of rocks;</p> <p>2.8. engineering and geological surveys at various stages of development of a subsoil area: substantiation of the accuracy and reliability of data, frequency of measurements, modern methods of obtaining data;</p> <p>2.9. engineering-geological monitoring at mining enterprises.</p>
Section 3. Engineering geodynamics	<p>3.1. general characteristics of mining and geological processes;</p>

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Course Title	Engineering and Geological Support of Subsoil Use
Course Workload (credits / academic hours)	7/252
Course contents	
Course Module Title	Brief Description of the Module Content
	<p>3.2. gravitational processes in open mining of mineral deposits;</p> <p>3.3. methods for assessing the stability of slope structures;</p> <p>3.4. mining and geological processes in the underground method of subsoil development;</p> <p>3.5. mining and geological phenomena when using physical and chemical geotechnology;</p> <p>3.6. designing measures to protect mine workings from negative phenomena;</p> <p>3.7. the influence of the seismic conditions of the territory on the conduct of mining operations.</p>
Section 4. Construction of engineering-geological models of rock masses	<p>4.1. concept of engineering-geological model;</p> <p>4.2. building 2D models;</p> <p>4.3. Building 3D models using modern mining and geological information systems;</p> <p>4.4. block engineering-geological models;</p> <p>4.5. features of the interpretation of physical and mechanical properties in engineering-geological models.</p>

Course Title	Mining Geology
Course Workload (credits / academic hours)	5/180
Course contents	
Course Module Title	Brief Description of the Module Content
Section 1. Fundamentals of mining geology	<p>1.1. subject, object, areas of application, goals and objectives of mining geology;</p> <p>1.2. mining and geological objects and factors of development of mineral deposits;</p> <p>1.3. volumetric and qualitative indicators of minerals;</p> <p>1.4. hydrogeological indicators and factors of field development;</p> <p>1.5. engineering-geological factors and indicators of field development;</p> <p>1.6. purpose and principles of geological exploration;</p> <p>1.7. stages of geological study of the subsoil;</p> <p>1.8. compilation of geological documentation: geological maps, sections, stratigraphic columns and symbols;</p> <p>1.9. methods for estimating mineral reserves.</p>
Section 2. Methods for obtaining and interpreting geological information	<p>2.1. geological materials used in the design;</p> <p>2.2. reliability of geological information and methods for its evaluation;</p> <p>2.3. geological support of operating mining enterprises;</p> <p>2.4. geological and geophysical work at an operating mining enterprise;</p> <p>2.5. hydrogeological and engineering-geological studies at existing mining enterprises</p>

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Course Title	Mining Geology
Course Workload (credits / academic hours)	5/180
Course contents	
Course Module Title	Brief Description of the Module Content
	2.6. assessment of the state of the rock mass; 2.7. accounting of the state and movement of mineral reserves at mining enterprises; 2.8. calculation of reserves, losses and dilution, accounting of the state and movement of reserves; 2.9. geological support for management of reserves and quality of minerals; 2.10. management of geological data at an operating enterprise; 2.11. construction of complex resource block models.
Section 3. International methods of reserves estimation	3.1. modern reserves accounting codes; 3.2. JORC Code: features, scope

Course Title	Modelling of Mineral Deposits
Course Workload (credits / academic hours)	7/252
Course contents	
Course Module Title	Brief Description of the Module Content
Section 1. Modeling in mining: types, main tasks and methods	1.1. modeling in geology and mining; 1.2. statistical processing of geological data; 1.3. initial data for geological modeling at the stage of exploration and development of the deposit; 1.4. formation of a database containing initial geological data to build a block model of a solid mineral deposit. Search for errors in the geological database; 1.5. calculation of the conditional component for complex fields.
Section 2. Mining and geological information systems	2.1. mining and geological information systems, the main functionality and differences of software products.
Section 3. Outlining and construction of wireframe models of ore deposits	3.1. delineation of ore bodies; 3.2. conditions and their interpretation in geometric and mathematical modeling; 3.3. wireframe modeling; 3.4. delineation of ore bodies in sections using a mining and geological information system; 3.5. substantiation of conditional parameters based on a variant enumeration (cut-off grade, minimum thickness of ore bodies, maximum thickness of barren interlayers); 3.6. operations on frames; 3.7. construction of a lithological model of an ore deposit.
Section 4. Block modeling of ore deposits of minerals	4.1. block modeling; 4.2. construction of a block model of an ore deposit in a mining and geological information system; 4.3. selection and justification of the size of the elementary unit of the block model; 4.4. block model evaluation;

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Course Title	Modelling of Mineral Deposits
Course Workload (credits / academic hours)	7/252
Course contents	
Course Module Title	Brief Description of the Module Content
	4.5. evaluation of the block model in the mining and geological information system.
Section 5. Fundamentals of geostatistics	5.1. basic geostatistical methods; 5.2. application of the IDW - method in modeling ore deposits of minerals. 5.3. substantiation of the parameters of the search ellipse based on the variability of the properties of geological bodies.
Section .6. Dynamic geological models	6.1. conditional modeling in modern mining and geological information systems; 6.2. frameless modeling; 6.3. application of neural network and other technologies for field modeling; 6.4. topographic surface modeling using neural networks; 6.5. the use of dynamic geological models in modern mining industry; 6.6. basics of simulation modeling: its scope, basic methods and approaches, experience in using simulation models to solve mining and geological problems.

Course Title	Sustainable Mining
Course Workload (credits / academic hours)	5/180
Course contents	
Course Module Title	Brief Description of the Module Content
Section 1. The concept of sustainable development	1.1. Formation of the concept of sustainable development. Global consequences of human influence on the biosphere. 1.2. Globalization of the world community and the role of international cooperation in achieving sustainable development. 1.3. United Nations Conference on Environment and Development. 1.4. Sustainable Development Goals. 1.5. The concept of Russia's transition to sustainable development.
Section 2. Aspects of sustainable development	2.1. Industrial Safety. 2.2. Resources and waste. 2.3. Climate problems. 2.4. Forest conservation. 2.5. Problems of the world ocean. 2.6. Urbanization. 2.7. Conservation of biological diversity. 2.8. Economic and legal mechanisms.
Section 3. Ensuring sustainable development of the enterprise.	3.1. Types of sustainability: market, production, financial and economic, organizational and managerial. 3.2. Ensuring environmental and social goals. 3.3. Ensuring innovative growth. 3.4. Technological solutions for sustainable development.

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Course Title	Sustainable Mining
Course Workload (credits / academic hours)	5/180
Course contents	
Course Module Title	Brief Description of the Module Content
	3.5. Green technologies.
Section 4. ESG rating and evaluation criteria.	4.1. Social Criteria 4.2. Corporate Criteria 4.3. Environmental Criteria

Course Title	Hydrogeology
Course Workload (credits / academic hours)	5/180
Course contents	
Course Module Title	Brief Description of the Module Content
Section 1. Fundamental hydrogeology	Topic 1.1. Water in the earth crust Topic 1.2. Properties of Aquifers Topic 1.3 Principles of Ground-Water Flow Topic 1.4 Types of Aquifers
Section 2. Water Chemistry	Topic 2.1. Major ions and trace elements chemistry Topic 2.2. Organic matter, gas composition and isotopes Topic 2.3. Origin of water chemical composition [^] mechanisms, stages, factors
Section 3. Applied hydrogeology	Topic 3.1 Water Quality and Ground-Water Contamination Topic 3.2 Ground-Water Development and Management

Course Title	Groundwater Dynamics
Course Workload (credits / academic hours)	4/144
Course contents	
Course Module Title	Brief Description of the Module Content
Section 1. Principles of Ground-Water Flow	Topic 1.1. General Laws Topic 1.2 Equations of Ground-Water Flow
Section 2. Ground-Water Flow to Wells	Topic 2.1. Computing Drawdown Caused by a Pumping Well Topic 2.2. Determining Aquifer Parameters from Time-Drawdown Data Topic 2.3 Estimating Aquifer Transmissivity from Specific Capacity Data Topic 2.4 Intersecting Pumping Cones and Well Interference Topic 2.4 Effect of Hydrogeologic Boundaries 208 Topic 2.5 Aquifer-Test Design

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Course Title	Mining Hydrogeology
Course Workload (credits / academic hours)	5/180
Course contents	
Course Module Title	Brief Description of the Module Content
Section 1. Hydrogeological conditions at different stages of the mining life cycle	Topic 1.1. Hydrogeological works at the stage of preparation for exploitation. Topic 1.2. Hydrogeological works at the stage of exploitation. Topic 1.3. Hydrogeological works at the stage of development and liquidation
Section 2. Hydrogeological investigations during the MD development by underground leaching	Topic 2.1 Hydrogeological investigations in the MD development by geotechnological methods (underground leaching of ore deposits). Topic 2.2. Hydrodynamic calculations in the development of ore deposits by underground leaching
Section 3. Hydrogeological investigations during the MD development by the open method	Topic 3.1 Methods of MD drainage. Drainage systems and drainage facilities for the MD development. Topic 3.2 Methods of hydrogeological calculations of water inflows to open and underground mine workings under various geological and hydrogeological conditions. Topic 3.3. Prediction of water inflows to mine workings.

Course Title	Applied Groundwater Modeling
Course Workload (credits / academic hours)	4/144
Course contents	
Course Module Title	Brief Description of the Module Content
Section 1. Principles and Procedures of Numerical Simulation	Topic 1.1. Introduction to Numerical Simulation Topic 1.2. Hydrodynamic Groundwater Calculations Topic 1.3. Theoretical framework of computer simulation in hydrogeology
Section 2. Seepage and Groundwater Flow	Topic 2.1. Types of Groundwater flow Topic 2.2. Spatial discretization groundwater flow
Section 3. Numerical simulation of groundwater system	Topic 3.1. Hydrogeological conceptual model development Topic 3.2. Calibration Hydrodynamic model Topic 3.3. Predictive Modeling and Validation

Course Title	Innovative Methods of Remote Research in Geology
Course Workload (credits / academic hours)	3/108
Course contents	
Course Module Title	Brief Description of the Module Content
Section 1. Remote sensing of the Earth.	1.1. Basics of Space Imagery. Russian and foreign means of remote sensing. 1.2. Tools and levels of remote sensing data processing
Section 2. Peculiarities of remote sensing methods application	2.1. Earth remote sensing in regional and large-scale prediction of deposits. 2.2. Peculiarities of remote sensing methods application in different regions

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Course Title	Geoinformation Systems for Geology Based on Space Imagery
Course Workload (credits / academic hours)	3/108
Course contents	
Course Module Title	Brief Description of the Module Content
Section 1. Geographic information systems, space imagery	1.1. General understanding of geographic information systems. Key skills of working in them 1.2. Theoretical foundations of satellite imagery. Data processing
Section 2. Geographic information system applications	2.1. Analysis of uranium mines in Africa based on satellite imagery in geographic information systems

Course Title	Technologies of Development of Mineral Deposits
Course Workload (credits / academic hours)	3/108
Course contents	
Course Module Title	Brief Description of the Module Content
Section 1. Principles of open mining of mineral deposits	1.1. types of open pits and quarry fields; 1.2. use and protection of subsoil; 1.3. determination of the final depth of a quarry for steeply dipping mineral deposits; 1.4. types, periods and procedure for the development of open pit mining, preparation of a quarry field for development; 1.5. placement of dumps; 1.6. construction of a calendar schedule for the mining operations.
Section 2. Opening of working horizons	2.1. career cargo flows, their types, characteristics, technological processes and conditions of formation; 2.2. opening mine workings, methods of opening, routes of opening workings, schemes and systems of stripping routes; 2.3. determination of the parameters and speed of sloping trenches in preparation for the development of a new horizon; 2.4. features of the opening of working horizons for different types of transport; 2.5. determination of the parameters and speed of cutting trenches.
Section 3. Development Systems Theory	3.1. general concepts about the development system; 3.2. main classifications of development systems and their principles; 3.3. calculation of the productivity of a quarry according to mining conditions for steeply dipping mineral deposits; 3.4. elements of the development system and their parameters.
Section 4. Theory of complex mechanization of open pit mining	4.1. general concepts and principles of complex mechanization of open pit mining; 4.2. technological classification of equipment complexes; 4.3. structural classification of mechanization links and equipment complexes;

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Course Title	Technologies of Development of Mineral Deposits
Course Workload (credits / academic hours)	3/108
Course contents	
Course Module Title	Brief Description of the Module Content
	4.4. the relationship of equipment within the complex, the basics of equipment configuration; 4.5. performance indicators of equipment complexes, scope of equipment complexes; 4.6. selection of an excavation and loading complex for mining operations and determination of the production capacity of a quarry with a simple non-transport scheme for transshipment of overburden rocks.
Section 5. Technological schemes of underground mining enterprises	5.1. technological schemes of mines; 5.2. technological schemes of mines; 5.3. cargo transportation processes; 5.4. production processes on the surface; 5.5. the relationship of the components of the technological scheme; 5.6. mineral extraction indicators.
Section 6. Uranium mining	6.1. genetic classification of uranium deposits; 6.2. morphological classification of uranium deposits; 6.3. review of uranium mining volumes by countries of the world; 6.4. analysis of the main technologies for uranium mining; 6.5. substantiation of the choice of technology for the development of a uranium deposit.
Section 7. Uranium mining technologies by in-situ leaching methods	7.1. basics of physical and chemical technology: scope, main indicators; 7.2. organization of reserves development by underground leaching methods; 7.3. development of uranium deposits using physical and technical geotechnology; 7.4. reagents used in the development of various types of deposits; 7.5. the influence of hydrogeological and engineering-geological conditions of the subsoil area on the organization of mining operations using leaching methods; 7.6. modes of mining operations; 7.7. environmental protection and integrated development of subsoil using physical and chemical geotechnology.

Course Title	Management of Reserves and Quality of Mineral Raw Materials
Course Workload (credits / academic hours)	3/108
Course contents	
Course Module Title	Brief Description of the Module Content
Section 1 Introduction	1.1. geological aspects of ore quality management; 1.2. essence and specifics of ore quality management.

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Course Title	Management of Reserves and Quality of Mineral Raw Materials
Course Workload (credits / academic hours)	3/108
Course contents	
Course Module Title	Brief Description of the Module Content
Section 2. Mathematical models and methods of geological control of ore quality	2.1. mathematical models used in the process of managing the quality of mineral raw materials; 2.2. information support for modeling redoflows; 2.3. geological methods of ore quality control; 2.4. modeling the processes of formation of ore flows and quality of ores; 2.5. statistical analysis; 2.6. ore quality control; 2.7. methods for the rapid determination of the qualitative characteristics of ores; 2.8. designing systems for collecting data on the quality of ores, products, as well as the composition of waste from a mining enterprise; 2.9. metal balance: methods of construction, determination of the causes of inconsistencies.
Section 3. Prediction of ore quality	3.1. forecasting the quality of ores in the bowels; 3.2. forecasting and statistical regulation of qualitative indicators; 3.3. geological information processing system for ore quality management; 3.4. prospects for the development of a system of geological support for ore quality management.
Section 4. Management of mineral reserves	4.1. establishing the right to use subsoil in various countries; 4.2. the sequence of involvement of subsoil plots in mining; 4.3. current control of the state of stocks.

Head of the Higher Education Programme:

Head of the Department
of Subsoil Use and Oil&Gas Engineering

Alexander E. Kotelnikov