

## Course/Module Description

<b>Organization (institution):</b> Kyrgyz Mining and Metallurgical Institute named after academician U. Asanaliev of the Kyrgyz State Technical University named after I. Razzakov (KSTU).
<b>Course Name:</b> Perspective Geotechnologies for Open Pit Mining of Mineral Deposits.docx
<b>Target group:</b> PhD doctoral students (Mining Engineering Program).
<b>Type (required/optional):</b> Elective part.
<b>Number of allocated credits ECTS (if applicable);</b> Design load: 10 ECTS (300 academic hours)
<b>Form of training (full-time/distance learning, etc.);</b> Number of classroom hours: 90 hours (full-time hours)
<b>Language of instruction:</b> Kyrgyz/Russian/English
<b>Prerequisites and related requirements (if applicable):</b> Spatial Data Science, Introduction to Geospatial Programming, Movement and Deformation of Rocks Due to Mining Operations, Remote Sensing in Mining, Knowledge of English to Read Literature.
<b>Course objectives:</b> Formation and acquisition of scientific and technical knowledge of effective open geotechnologies and the creation of “smart quarries”.
<b>Learning outcomes:</b> <b>The student will be able to:</b> LO1: carry out scientific and technical activities to achieve effective open geotechnologies (low waste, resource saving, resource reproduction, continuity of excavation, loading and transportation processes, etc.); LO2: scientifically substantiate and create models of the state of the subsoil (relief, climate, geology, hydrogeology, tectonics and other characteristics) for visualization in space and time, with the aim of designing a “smart quarry” and planning open-pit mines and operations, considering predicted negative natural factors of the deposit; LO3: scientifically substantiate and create new schemes, methods and methods of conducting production processes of open-pit mining that ensure the complexity of deposit development, industrial and environmental safety; LO4: scientifically substantiate and develop new methods of geometrization of deposits for open-pit mining, properties and conditions of rock masses as the basis for the geometry of subsoil qualimetry, optimization of operational exploration networks, calculation and adjustment of reserves, forecasting conditions for safe and rational development of subsoil, parameters of stable benches and sides of quarries and dumps, determination of losses and dilution of mineral resources; LO5: scientifically substantiate and develop new computer systems for geological and surveying support for managing the quality of minerals in quarries.
<b>Contents</b> 1. Mineral resources mined by open-pit mining, characteristics of rocks, determination of the main parameters of the quarry; 2. Review and analysis of new geotechnologies in open-pit mining in foreign countries, patent studies of scientific and technical achievements in open-pit geotechnologies, comparison of their applicability in domestic deposits; 3. Optimization of quarry fields and their opening, open-pit mining systems, the structure of their complex mechanization and visualization of the results obtained in space and time, based on a preliminary assessment and forecasting of the natural geomechanical state of the deposit's rock mass with the construction of a financial model of the enterprise considering environmental and economic factors aspects and requirements of industrial safety, including: 3.1 Modeling of the geomechanical state of the quarry rock mass (structural features; physical and mechanical properties of the rocks composing the rock mass; natural stress-strain state, etc.);

- 3.2 Modeling of methods for preparing rock mass for excavation in a quarry (mechanical, hydraulic, physical, chemical, combined, explosive);
- 3.3 Modeling of excavation and loading of rocks in a quarry (excavator, loader, bulldozer, scraper), movement of quarry cargo (automobile, rail, conveyor, combined), dumping (automobile, conveyor, scraper, combined, etc.);
- 4. Open geotechnology in the development of coal deposits;
- 5. 5. Modeling of an explosive method for preparing rock mass for excavation during open-pit mining of complex structural deposits;
- 6. Open geotechnology in the development of placer deposits.

**Recommended or required literature and other learning resources/tools:**

- 1. Lecture materials
- 2. Course materials will be available through ELMS.
- 3. Lecture slides Power Point available for download in the format .PDF on the course website.
- 4. Electronic resources on the topics of lectures are available on the course website.
- 5. Lesson notes, recent journal articles, and links related to course topics will be mentioned and/or distributed during lectures.
- 6. Texts and reference books on the discipline

**Planned training activities and teaching methods:**

- 1. Regular and lecture consultation;
- 2. Laboratory and computational tasks;
- 3. Individual practical exercises with materials of mineral deposits;
- 4. 8. Discussions in Audiences.

**Evaluation methods and criteria:**

- 1. Midterm exam (25%)
- 2. Laboratories and computational tasks (25%)
- 3. Discussion/participation in Audiences (10%)
- 4. Final exam 40%
- 5. Ratings: A, B, C, D, E, Fx, F

**For more information:** course teacher – Doctor of Technical Sciences, Professor Abdiev A.R.

Authors: Vokin V.N., Morozov V.N., Nazarova E.Yu., Kaderov M.Yu. Open geotechnology. Textbook, 2013

Authors: Mambetov Sh.A., Abdiev A.R., Mambetov A.Sh. Mining work in the Tien Shan. monograph, 2013.

Authors: Malofeev D.V. Macromine workbook using the example of a coal field, 2021.

Authors: Mambetov Sh.A., Abdiev A.R., Mambetova R.Sh. Fundamentals of geomechanics. Classic university textbook, 2020.