Graduate Certificate in Mining Engineering

Underground Mining Methods and Equipment

Underground Mining Methods and Equipment:

Underground mining is a method of extracting minerals and ores that are buried deep underground. This process involves creating tunnels or shafts to access the mineral deposits. Various mining methods and equipment are used to extract these resources efficiently and safely. Understanding the different underground mining methods and equipment is crucial for mining engineers to optimize production and ensure the safety of workers.

Key Terms and Vocabulary:

1. Shaft Mining: Shaft mining involves creating vertical tunnels to access mineral deposits deep underground. This method is commonly used for accessing coal, diamonds, and other valuable minerals.

2. Drift Mining: Drift mining involves creating horizontal tunnels to access mineral deposits. This method is often used when the mineral deposit is located near the surface or in a gently sloping ore body.

3. Room and Pillar Mining: Room and pillar mining is a method where large underground rooms are excavated, leaving pillars of ore to support the roof. This method is commonly used in coal mining.

4. Longwall Mining: Longwall mining is a highly efficient method of underground mining where a long wall of coal or ore is mined in a single slice. This method is used to extract large deposits of coal or other minerals.

5. Sublevel Caving: Sublevel caving is a method of underground mining where ore is blasted and allowed to collapse under its weight. This method is used for massive ore bodies that are too deep to be mined using other methods.

6. Block Caving: Block caving is a method of underground mining where ore is removed from a large block of rock that is slowly caving in. This method is used for large, low-grade ore bodies.

7. Room and Pillar Mining Equipment: Room and pillar mining equipment includes continuous miners, shuttle cars, roof bolters, and other machinery used to extract ore in room and pillar mines.

8. Longwall Mining Equipment: Longwall mining equipment includes shearers, armored face conveyors, and roof supports used to extract coal or ore in longwall mines.

9. Sublevel Caving Equipment: Sublevel caving equipment includes drill rigs, loaders, and conveyors used to extract ore in sublevel caving mines.

10. Block Caving Equipment: Block caving equipment includes drawbells, crushers, and conveyors used to extract ore in block caving mines.

11. Rock Bolting: Rock bolting is a method of reinforcing the roof and walls of underground mines to prevent collapses. This technique involves drilling holes into the rock and inserting bolts to hold it in place.

12. Backfilling: Backfilling is a method of filling in mined-out areas with waste rock or tailings to provide support for the roof and prevent subsidence.

13. Ventilation: Ventilation is essential in underground mines to provide fresh air for workers and remove harmful gases and dust. Ventilation systems include fans, ducts, and airways.

14. Rock Drills: Rock drills are used to drill blast holes in underground mines for blasting operations. These drills come in various sizes and types, including handheld drills and jumbo drills.

15. Hoisting Equipment: Hoisting equipment is used to lift ore, equipment, and personnel in and out of underground mines. Hoists, winches, and elevators are commonly used for this purpose.

16. Blasting: Blasting is a common method of breaking up rock in underground mines to access ore deposits. Controlled explosions are used to fragment the rock for easier extraction.

17. Ground Support: Ground support systems are used in underground mines to reinforce the roof and walls. This includes rock bolts, shotcrete, mesh, and other materials to prevent collapses.

18. Mucking: Mucking is the process of removing broken rock and ore from underground mines. This is done using loaders, trucks, and conveyor belts to transport the material to the surface.

19. Water Management: Water management is crucial in underground mines to prevent flooding and ensure the safety of workers. This includes dewatering systems, pumps, and drainage channels.

20. Geotechnical Engineering: Geotechnical engineering is the branch of engineering that deals with the behavior of rocks and soils in underground mines. This includes slope stability, ground support, and rock mechanics.

Challenges in Underground Mining:

1. Ground Control: Maintaining the stability of the roof and walls in underground mines is a significant challenge. Ground control systems must be implemented to prevent collapses and ensure the safety of workers.

2. Ventilation: Providing adequate ventilation in underground mines can be challenging, especially in deep or complex mining operations. Proper ventilation systems are crucial to maintaining air quality and preventing respiratory issues.

3. Water Management: Managing water in underground mines is a constant challenge due to the risk of flooding and water ingress. Dewatering systems must be in place to remove excess water and prevent accidents.

4. Safety: Safety is a top priority in underground mining, as the working conditions can be hazardous. Proper training, safety protocols, and equipment maintenance are essential to prevent accidents and

injuries.

5. Productivity: Maximizing productivity in underground mines requires efficient mining methods and equipment. Continuous improvement and optimization of processes are necessary to increase output and reduce costs.

6. Environmental Impact: Underground mining can have a significant environmental impact, including habitat destruction, water pollution, and air emissions. Sustainable mining practices and reclamation efforts are essential to mitigate these effects.

7. Regulatory Compliance: Underground mining operations must comply with various regulations and standards to ensure the safety of workers and protect the environment. Compliance with permits, inspections, and reporting requirements is essential.

Examples of Underground Mining Methods:

1. Room and Pillar Mining: In a room and pillar coal mine, large rooms are excavated using continuous miners, leaving behind pillars of coal to support the roof. This method is efficient for extracting coal in thick seams.

2. Longwall Mining: In a longwall coal mine, a shearer is used to extract a long wall of coal in a single pass. The coal is then transported by armored face conveyors to the surface for processing.

3. Sublevel Caving: In a sublevel caving mine, ore is blasted and allowed to collapse under its weight. The ore is then collected using loaders and transported to the surface for further processing.

4. Block Caving: In a block caving mine, a large block of ore is extracted by undercutting it and allowing it to cave in. The ore is then crushed and transported to the surface for processing.

5. Drift Mining: In a drift mine, horizontal tunnels are excavated to access mineral deposits near the surface. This method is commonly used for extracting gold, copper, and other valuable minerals.

6. Shaft Mining: In a shaft mine, vertical tunnels are excavated to access mineral deposits deep underground. This method is used for extracting diamonds, potash, and other minerals.

Practical Applications in Underground Mining:

1. Coal Mining: Underground coal mining is a common application of underground mining methods. Room and pillar mining and longwall mining are used to extract coal from deep underground seams.

2. Hard Rock Mining: Underground hard rock mining is used to extract minerals such as gold, copper, and nickel. Sublevel caving and block caving are effective methods for extracting ore in hard rock mines.

3. Salt Mining: Underground salt mining involves extracting salt deposits from deep underground using room and pillar mining or solution mining methods. Salt is used in various industries, including food processing and chemical production.

4. Potash Mining: Potash is mined underground using shaft mining methods to access deep-seated potash deposits. Potash is a key ingredient in fertilizers, making it essential for agriculture.

5. Uranium Mining: Underground uranium mining is used to extract uranium ore for nuclear power generation. Sublevel caving and drift mining are common methods for extracting uranium deposits.

6. Lead and Zinc Mining: Underground lead and zinc mining operations use room and pillar mining and longwall mining methods to extract ore for metal production. Lead and zinc are used in various industries, including construction and battery manufacturing.

Conclusion:

Understanding the key terms and vocabulary related to underground mining methods and equipment is essential for mining engineers to effectively plan, design, and operate underground mines. By mastering these concepts, mining professionals can optimize production, ensure the safety of workers, and minimize environmental impact in underground mining operations. Continuous improvement and innovation in underground mining methods and equipment are crucial for the sustainable development of the mining industry.