



## **VIGYAAN PROBLEM STATEMENTS**

### **(Department of Mining Engineering)**

#### **1. Optimising Time and Improving Production**

Design a mathematical model for a given case study to optimise the time and improve the production in shift. The required data is given below:

- Shift Time = 8am to 4pm.
- Number of LPDT = 7, capacity of LPDT is 20 tonne.
- Number of LHD = 4, capacity of LHD is 7 tonne.
- Dumping is done at 250 MRL.
- Production at 30 MRL and 0 MRL.
- Travelling time for empty LPDT is 20 min.
- Travelling time for filled LPDT is 30 min.
- Time taken to fill one LPDT from a LHD is 7 min.
- LPDT workshop for per shift maintenance is located at 250 MRL.
- LPDT maintenance time 25 min. in each shift.

LPDT – Low Profile Dump Truck

LHD – Load Haul Dump

#### **2. Extraction of Coal at Greater Depth**

Propose a suitable and effective methodology for extraction of coal at a depth of 500m for Indian geo-mining (DEEPCOAL). The major objective of the project is to prepare guidelines, monograms and design methodology for extraction of coal at a depth of 500m for Indian geo-mining conditions. The allied objectives are:

- Scientific investigations for design and planning of mining methods for deep mines; .
- Development of methodology for assessment and design of ventilation parameters for deep shaft coal mines;
- Development of high concentration and high rate filling technology for extraction of deep seated coal seam;
- Simulation and visualization of deep mining and geosciences problems;
- Simulation of the caving of strata overlying coal seam, support-strata interaction during extraction and development of guidelines for design of suitable mining method for deep mines; and
- Geostatistical classification of roof rocks and selection of mining methods for deep mines.

### 3. Open Cast Pit Mining

Design an open cast pit layout to achieve 3 MT per year of coal production using the following information:

- Thickness of topmost seam = 3m;
- Thickness of bottommost seam = 3m;
- Seam gradient = 1 to 30°;
- Density of coal = 1.3;
- Haul-road gradient = 1 in 16
- Mine lease hold area = 1000ha
- Area of mining block = 700 ha
- Mine Reserve = 50 MT
- Type of Rock:
  - Soil = 3m
  - Sandstone = 15m
  - Shale = 7m

Suggest the next efficient /suitable equipment with type, size and other details required for block filling and coal extraction.

- Stripping ratio = 3:1;
- No. of seam = Two;
- Depth of cover at in C ref of top most seam = 25m
- Parting between topmost and bottom most seam = 6m;

### 4. Extraction of Contiguous Seams

When the parting distance between two seams is less than 9m, then they are called Contiguous Seams. Due to this small parting distance these cannot be extracted as simple seams. After getting permission from the concerned authorities, the methods of extraction are:

- **First extracting the upper seam followed by the extraction of lower seam.** But this method has many drawbacks. During the extraction process, the gob of the upper seam may get filled with water and if the parting distance is too less and the seams are highly inclined, undermining may occur. Also crushing may occur if the parting distance is too less. Prepare a model explaining this method of extraction of contiguous seams and also suggesting possible changes to be made to overcome the above mentioned problems.

- **First extracting the lower seam followed by extraction of upper seam.** But there are some major problems faced during the process. Uneven gradients, floor lifts and fractured roof may be faced while working in the upper seam as a result of prior excavation of the lower seam.

Prepare a model explaining this method of extraction of contiguous seams and also suggesting possible changes to be made to overcome the above mentioned problems.

- **Simultaneous extraction of both the seams.** Although this method has proven to be advantageous over the other methods (extraction from 1 seam at a time) and a lot more productive, it has violent surface effects.

Prepare a model suggesting some innovative changes to be made in the process of extraction to reduce the surface effects without affecting the production.

## 5. Artificial Intelligence

Mining industry is one of the oldest industries of the world. The Mining Industry plays an important role in the economic development of a country. Currently, there is a big difference between demand and supply which tells us that the current methods are not much effective. Artificial Intelligence, in this context, has presented us the idea of Smart Mines and has resulted in increased human safety as well as increased efficiency. As this technology is still under development, there is much more that can be added to the idea of Smart Mine.

Prepare a model depicting a Smart Mine which you can vision in 2050 in Indian Mining Industry.

## 6. Open Cast Mining

Assume your suitable data.

In an open cast iron ore mine

Calculate the total capacity of the mine and machine to mine within 5 year

Borehole data of samples during prospecting gives the pocket of iron ore and haematite having stripping ratio of  $10 \text{ m}^3$  per tonne

Depth of deposit is 200m hilly and surrounded with BHQ as a host rock. The strike length is  $1500\text{m} \times 1000\text{m}$ . Hill is a rectangular prism shape before excavation. The grade of iron ore is 72 percent and pocket is square shape of  $500 \times 500\text{m}$  with height is 81m.

The benches are formed with height 10m. Also design the haul road with bench parameters for smooth working.