

# DIPLOMA WALLAH

## JHARKHAND UNIVERSITY OF TECHNOLOGY (JUT)

3rd Semester Diploma in Mining Engineering | Subject: Opencast Mining (MIN301)

### SAMPLE PAPER - 2

#### Instructions :

- **Full Marks:** 70 | **Time:** 3 Hours
- Question No. 1 is **compulsory** (7 MCQs x 2 Marks = 14 Marks).
- Answer any **FOUR** questions from the remaining (Q.2 to Q.7). Each carries 14 marks.
- Illustrate your answers with neat sketches/diagrams wherever necessary.
- Assume suitable data if missing in numericals.

#### Q.1 Choose the correct option for the following:

[7 × 2 = 14]

i. Which of the following heavy earth moving machineries (HEMM) rests on the surface it excavates and digs below its level?

- (a) Rope Shovel
- (b) Dragline
- (c) Front-end Loader
- (d) Continuous Miner

ii. LOX stands for which type of explosive used in mining?

- (a) Liquid Oxygen Explosive
- (b) Low Output Explosive
- (c) Liquid Oxide Explosive
- (d) Large Opencast Explosive

iii. The horizontal distance between the toe of the bench and the first row of blastholes is called:

- (a) Spacing
- (b) Stemming
- (c) Burden
- (d) Sub-grade

iv. Rear discharge, side discharge, and bottom discharge are classifications of which equipment?

- (a) Scrapers
- (b) Bull-dozers
- (c) Dumpers
- (d) Dipper Shovels

v. Deck charging is a technique specifically related to:

- (a) Multi-seam Blasting
- (b) Wagon Drilling
- (c) Shovel Loading
- (d) Dumper Haulage

**vi. What is the standard measurement unit of "Powder Factor" in coal opencast mines?**

- (a) kg/tonne
- (b) Tonnes/kg or m<sup>3</sup>/kg
- (c) kg/m<sup>2</sup>
- (d) Tonnes/meter

**vii. Which initiation device does NOT use electricity and is highly safe against stray currents?**

- (a) Electric Detonator
- (b) Exploder
- (c) Shock tubes (NONEL)
- (d) Circuit Tester

**Q.2 (A)** Classify the different types of explosives used in opencast mines. Explain the composition, properties, and usage of ANFO and Site Mixed Slurry (SMS) in detail. [7]

**Q.2 (B)** What are the basic properties of a good explosive? [7]

**Numerical:** In a bench blasting operation, 10 holes are drilled. The spacing is 4m, burden is 3m, and the bench height is 6m. Each hole is charged with 15 kg of explosives. Assuming the density of the rock is 2.5 tonnes/m<sup>3</sup>, calculate:

- (i) Total volume of rock blasted
- (ii) Total explosive used
- (iii) Powder Factor (in tonnes/kg).

**Q.3 (A)** Discuss in detail the parameters considered for the design of Bench Height, Bench Width, and Bench Slope for mechanized opencast mining. [7]

**Q.3 (B)** What are the merits and demerits of keeping larger bench heights in surface mines? [7]

**Q.4 (A)** Explain the working operation and layout of a Dragline working along with a shovel and dumper combination in a deep opencast mine. [7]

**Q.4 (B)** Explain the construction, operation, and specific applications of a Back-hoe in surface mining. [7]

**Q.5 (A)** Explain the construction and working principle of a Wagon Drill with suitable sketches. [7]

**Q.5 (B)** Describe the various control measures for water and the drainage system constructed on haul roads in an Opencast Mine (OCM). [7]

**Q.6 (A)** Discuss the principles of operation, attachments, and main uses of a Bull-dozer in opencast mining. [7]

**Q.6 (B)** What are the primary factors and salient points considered for the selection of haulage/transporting equipment in opencast mines? [7]

**Q.7 Write short notes on any FOUR of the following:** [4 × 3.5 = 14]

A. Quarriable Limit

- B. Deck Charging technique
- C. Basic Principles of Mine Reclamation
- D. Rear discharge vs Bottom discharge dumpers
- E. Shock tubes (NONEL)

## PAPER 2 - ANSWER KEY & MODEL HINTS

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**Q1 (MCQ Answers):** i-(b), ii-(a), iii-(c), iv-(c), v-(a), vi-(b), vii-(c)

### **Model Hints for Theory & Numericals:**

**Q2(A) Explosives:** ANFO (Ammonium Nitrate Fuel Oil) is a cheap, low-density mixture but not water-resistant. SMS (Site Mixed Slurry) is mixed on-site using pump trucks, is highly water-resistant, and provides good fragmentation.

### **Q2(B) Numerical Solution:**

(i) Volume of rock per hole = Spacing  $\times$  Burden  $\times$  Bench Height =  $4\text{m} \times 3\text{m} \times 6\text{m} = 72 \text{ m}^3$ .

Total Volume for 10 holes =  $72 \times 10 = 720 \text{ m}^3$ .

Total Tonnage of rock = Volume  $\times$  Density =  $720 \text{ m}^3 \times 2.5 \text{ tonnes/m}^3 = 1800 \text{ tonnes}$ .

(ii) Total Explosive used = 10 holes  $\times$  15 kg = **150 kg**.

(iii) Powder Factor = Total Tonnage / Total Explosive =  $1800 \text{ tonnes} / 150 \text{ kg} = 12 \text{ tonnes/kg}$ .

**Q3(A) Bench Design:** *Height:* Strictly depends on the maximum digging reach of the excavator (e.g., shovel). *Width:* Should not be less than bench height, plus room for dumper turning radius and clearance. *Slope:* Depends on the geological strength of the rock to prevent slope failure.

**Q4(A) Dragline Layout:** A dragline sits on the top of the bench and digs below its own level, dumping the overburden directly into the previously mined-out area (goaf). Meanwhile, a shovel-dumper combination can be used simultaneously on the upper benches or for coal extraction.

**Q6(A) Bull-dozer Uses:** A heavy tractor equipped with a front steel blade. Used for leveling OB dumps, cleaning the blasting face for shovels, grading haul roads, and short-distance pushing of materials.

**Q7 Short Notes:** *Quarriable Limit:* The physical or economic boundary up to which mining can be done. *Deck Charging:* Separating explosive charges in a single hole using stemming material to reduce vibrations. *NONEL:* Non-electric shock tubes that transfer a shock wave to initiate detonators safely.