DIPLOMA WALLAH

JHARKHAND UNIVERSITY OF TECHNOLOGY (JUT)

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

SAMPLE PAPER - 1

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. The economical boundary up to which opencast mining can be done profitably is determined by:

(a) Cut-off grade   (b) Stripping ratio

(c) Bench slope angle   (d) Powder factor

ii. Which of the following explosives is a simple mixture of Ammonium Nitrate and Fuel Oil?

(a) LOX   (b) SMS

(c) ANFO   (d) Emulsion

iii. A Dragline excavator is generally positioned on:

(a) The coal seam   (b) The overburden bench (Top of the cut)

(c) The main haul road   (d) The floor of the pit

iv. Which of the following machineries provides 'continuous' excavation rather than cyclic?

(a) Rope Shovel   (b) Bucket Wheel Excavator (BWE)

(c) Scraper   (d) Dragline

v. Plaster shooting and Pop shooting are terms associated with:

(a) Primary bench blasting   (b) Secondary blasting

(c) Sub-grade drilling   (d) Pre-splitting

vi. The initial trench made to open a surface mine and provide access to the mineral is known as:

(a) Drop cut
(b) Box cut

(c) Slice cut
(d) Ramp cut

vii. What is the main function of 'Stemming' in a blast hole?

(a) To increase the explosive power
(b) To transmit the detonation wave

(c) To confine the explosive energy
(d) To keep the explosive dry

Q.2 (A) Explain the main factors affecting the choice of opencast mining methods. What are the favorable conditions for adopting opencast mining over underground mining? **[7]**

Q.2 (B) Define Ultimate Pit Limit and Stripping Ratio. **[7]**

Numerical: In an opencast mine, the total volume of overburden to be removed is 1,20,000 cubic meters to extract 40,000 tonnes of coal. Calculate the Stripping Ratio for this mine. If the maximum allowable stripping ratio is 4:1, is this mining operation economically viable?

Q.3 (A) Describe the construction and working principle of a Down-The-Hole (DTH) Drill with a neat diagram. **[7]**

Q.3 (B) Define the following blast parameters used in opencast mines with the help of a basic bench diagram: (i) Burden, (ii) Spacing, (iii) Depth of hole, and (iv) Sub-grade drilling. **[7]**

Q.4 (A) Compare a Rope Shovel with a Hydraulic Shovel based on their construction, breakout force, and mobility. **[7]**

Q.4 (B) Describe the layout of a Dipper Shovel and Dumper combination for overburden removal in a mechanized opencast mine. **[7]**

Q.5 (A) Discuss the important points to be kept in mind while designing haul roads in an opencast mine. **[7]**

Q.5 (B) What safety measures must be taken on haul roads? Explain the control measures for water and drainage systems constructed on haul roads. **[7]**

Q.6 (A) Explain the construction, operation, and working principle of a Bucket Wheel Excavator (BWE). **[7]**

Q.6 (B) Describe the construction and operation of a Dragline. Explain its bucket mechanism. **[7]**

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

A. Pop shooting vs Plaster shooting

B. Box Cut and its importance

C. Front-end Loader (Wheel Loader)

D. Safe transportation of explosives in mines

E. Placer Mining

PAPER 1 – ANSWER KEY & MODEL HINTS

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

Model Hints for Theory:

Q2(A) Factors: Depth of deposit, stripping ratio, topography, production requirement. Favorable conditions: shallow deposits, thick massive seams, low stripping ratio.

Q2(B) Numerical Solution:
Stripping Ratio = Volume of Overburden (m³) / Tonnage of Ore (tonnes)
Stripping Ratio = 1,20,000 / 40,000 = **3 m³/tonne (or 3:1)**.
Since the calculated stripping ratio (3:1) is less than the maximum allowable ratio (4:1), **Yes, the mining operation is economically viable.**

Q3(A) DTH Drill: The hammer mechanism is located down the hole directly behind the drill bit. This prevents energy loss in drill rods. Gives high penetration rate and less hole deviation. (Draw basic block diagram showing bit, hammer, and drill tube).

Q3(B) Blast Parameters: *Burden:* Distance from the blast hole to the nearest free face. *Spacing:* Distance between two adjacent holes in the same row. *Sub-grade drilling:* Drilling below floor level to avoid toe formation.

Q4(A) Rope vs Hydraulic Shovel: Rope uses wire ropes/winches, longer life, handles very hard fragmented rock. Hydraulic uses pressurized fluid cylinders, better breakout force at bucket teeth, highly mobile.

Q7 Short Notes: *Box Cut:* First trench to open mine, provides a free face. *Front-end loader:* Tractor with front bucket, scoops loose material into dumpers. *Plaster shooting:* Mud capping explosive on boulder without drilling. *Pop shooting:* Drilling a small hole in boulder and blasting.

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