



**GWANDA STATE UNIVERSITY**  
**FACULTY OF ENGINEERING AND THE ENVIRONMENT**  
**DEPARTMENT OF MINING ENGINEERING**  
**SURFACE MINING TECHNOLOGY (EMN 2107)**  
**SEPTEMBER 2024**

**Time Allowed:** 3 hours  
**Examiner's Name:** Mr. P Sithole  
**Authorized Material:** Calculator

**INSTRUCTIONS**

1. The question paper contains **FIVE (5)** questions.
2. Answer **QUESTION NUMBER ONE** and any other **THREE** questions from the remaining questions.
3. Each question carries **25 marks**.
4. Where a question contains subdivisions, the mark value of each subdivision is shown in brackets.
5. Illustrate your answer, where appropriate, with large clearly labelled diagrams.
6. Be as **INFORMATIVE** as you can be.
7. Start each question on a new page.
8. This examination paper consists of **FOUR (4)** printed pages

**NB: DO NOT TURN OVER THE QUESTION PAPER OR COMMENCE WRITING UNTIL INSTRUCTED TO DO SO**

### QUESTION ONE

- a) Rotary drilling generally produces large cuttings during flushing, thus yielding high drill speeds and low dust. Describe a situation where excessive dust, accelerated bit wear and reduced penetration rate can occur during rotary drilling. **[6 Marks]**
- b) Briefly describe the five (5) fundamental guidelines for initial blast design. **[10 Marks]**
- c) Explain three (3) reasons why access ramps into a Strip mine are mostly located in the low wall side of the mine. **[6 Marks]**
- d) Indicate three (3) geological conditions which render draglines ineffective stripping equipment in a deposit that is amenable to Terrace mining. **[3 Marks]**

### QUESTION TWO

- a) With the aid of a sketch or sketches, illustrate the following terms used in surface mining: overall pit slope, burden, sub drill, safety berm, bench angle, ramp grade, safety bench. **[7 Marks]**
- b) What is the significance or purpose of each of the terms in (a) above? **[14 Marks]**
- c) Distinguish between pre-splitting and post-splitting. **[4 Marks]**

### QUESTION THREE

- a) Give an overview of the sequence of production operations in Strip mining. **[6 Marks]**
- b) i. With the aid of a diagram, describe the four (4) principal Strip mine box cut orientations and their directions of advance. **[12 Marks]**
- ii. Select and briefly explain the suitability of a particular box cut orientation for the purpose of early return on the invested capital at a Strip mine. **[2 Marks]**
- c) State two (2) disadvantages of using long strips for dragline operations at a coal Open Cast mine. **[2 Marks]**
- d) What is cycle time in a hauling operation and what is its significance? **[3 Marks]**

#### QUESTION FOUR

- a) State the conditions (with respect to ore body shape, ore body dip, waste handling methodology) which suit application of each of the following surface mining methods:
- Terrace mining [3 Marks]
  - Strip mining [3 Marks]
  - Open pit mining. [3 Marks]
- b) With the aid of a diagram(s), illustrate how pit expansion is done by sequential and conventional pushbacks. [10 Marks]
- c) Graphically sketch the effect of rock fragmentation on the following:
- Drill and Blast costs; [3 Marks]
  - Crushing costs; and [3 Marks]

#### QUESTION FIVE

Dyke Track Pvt. Ltd. operates an Open Pit mine which has switch back haul roads. The haul road network has a partially compacted gravel surface and the maximum allowed speed along the haul route is 30km/hr. Figure 1 illustrates a dump truck moving downslope along a switch back which has a grade of 8% and banks at 0.090m/m of road width.

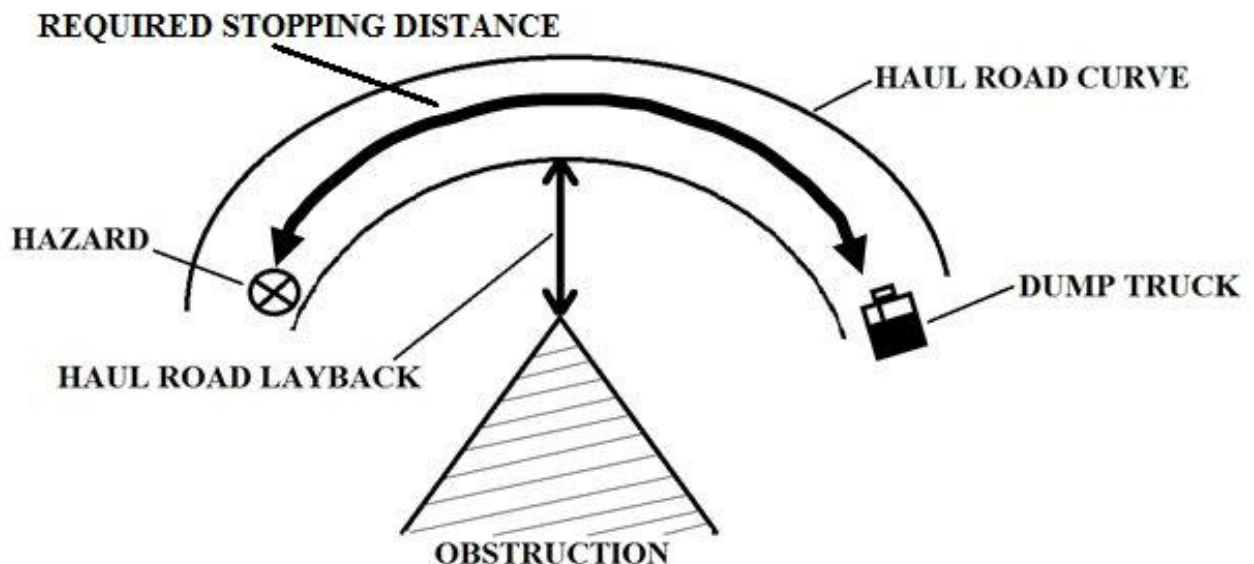


Figure 1

- a) i. Considering Figure 1, compute a safe distance, from the hazard, at which a “Danger Ahead” sign post must be installed for the oncoming dump truck. **[3 Marks]**
- ii. Calculate the minimum required haul road layback. **[5 Marks]**
- b) i. Briefly describe a systematic approach for designing an optimal haul road maintenance program for the mine. **[10 Marks]**
- ii. Briefly explain, with one (1) reason, why ad hoc and scheduled blading are inefficient methods of haul road maintenance at Dyke Track mine. **[2 Marks]**
- c) Explain why reactionary and scheduled maintenance strategies are not preferred for haul road maintenance. **[5 Marks]**

**---END OF EXAMINATION---**