NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF ENGINEERIND AND SPATIAL SCIENCES

DEPARTMENT OF MINING, MECHANICAL AND PROCESS ENGINEERING

QUALIFICATION : BACHELOR OF ENGINEERING (BEng) – MINING ENGINEERING	
QUALIFICATION CODE: 08BMIN-05	LEVEL: 7
COURSE CODE: UDM711S	COURSE NAME: UNDERGROUND MINING 315
SESSION: JUNE 2022	PAPER: THEORY AND CALCULATIONS
DURATION: 2 HOURS	MARKS: 100

FIRST OPPORTUNITY QUESTION PAPER	
EXAMINER	Mr. Tshivute Iipinge
MODERATOR:	Dr. MalliKarjun Pillalamarry

INSTRUCTIONS	
	1. Answer all questions.
	2. Read all the questions carefully before answering.
	3. Marks for each question are indicated at the end of each question.
	4. Please ensure that your writing is legible, neat, and presentable.

PERMISSIBLE MATERIALS

1. Examination paper.

THIS QUESTION PAPER CONSISTS OF 4 PAGES (Including this front page)

Question 1

There is a vertical ore deposit as indicated on figure 1. Vertical shaft was designed to be sunk in position 1, 2 as indicated in the diagram. Compare and contrast these two scenarios and suggest the preferred scenario. Support your preference. (8 marks)
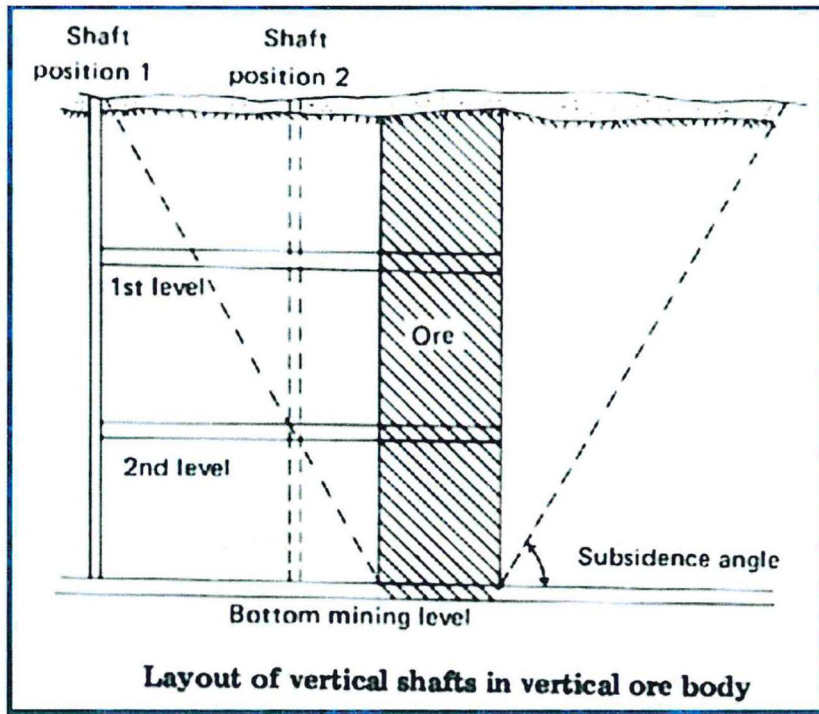

Layout of vertical shafts in vertical ore body

Figure 1. Diagram showing the lay out of vertical shaft positions 1 and 2 o-in vertical orebody

Question 2

The block development work is an important part of underground mine development to successful mine the orebody. What are the factors you should take in consideration while developing main level layout development? (8 marks).

Question 3

Many factors influence the decision of selecting a shaft or decline/ramp to access an underground mine. Describe some of these factors that influence your decision of selecting the access to your orebody. (8 marks).

Question 4

Given the following data for the design of friction sheave hoists; calculate the total cycle time and skip capacity and its weight.

Two balanced skips, tower mounted hoists

Production rate = 8000 tons/day

Working time = 3 shift/day

Shaft distance = 1200 m

Headframe height = 35m

Skip load = 0.67 live load

Load time = dump time = 6 sec

Hoisting speed = 12.5 m/sec

Acceleration = retardation = 2.3 m/s^2

(12 marks)

Question 5

As a mining engineer you are required to develop a drift of about 600m along the orebody with a Jumbo drill. The drift (tunnel) dimensions are as follows:
  a) 5.5m x 5m
  b) Drill steel 4.5 m
  c) 3 shifts
  d) Actual drill meter per round 4 m
  e) Efficiency of 85 %
  f) Specific gravity of rock is 2.5 t/m^3

Calculate the development meters per day and per week? Estimate how long will you develop the tunnel, the number of tonnages to be hauled per day, week, for the entire length of 600m? (10 marks).

Question 6

As a mine planning engineer, describe the six dimensions that are vital in characterising the work conditions of your equipment selection? (12 marks).
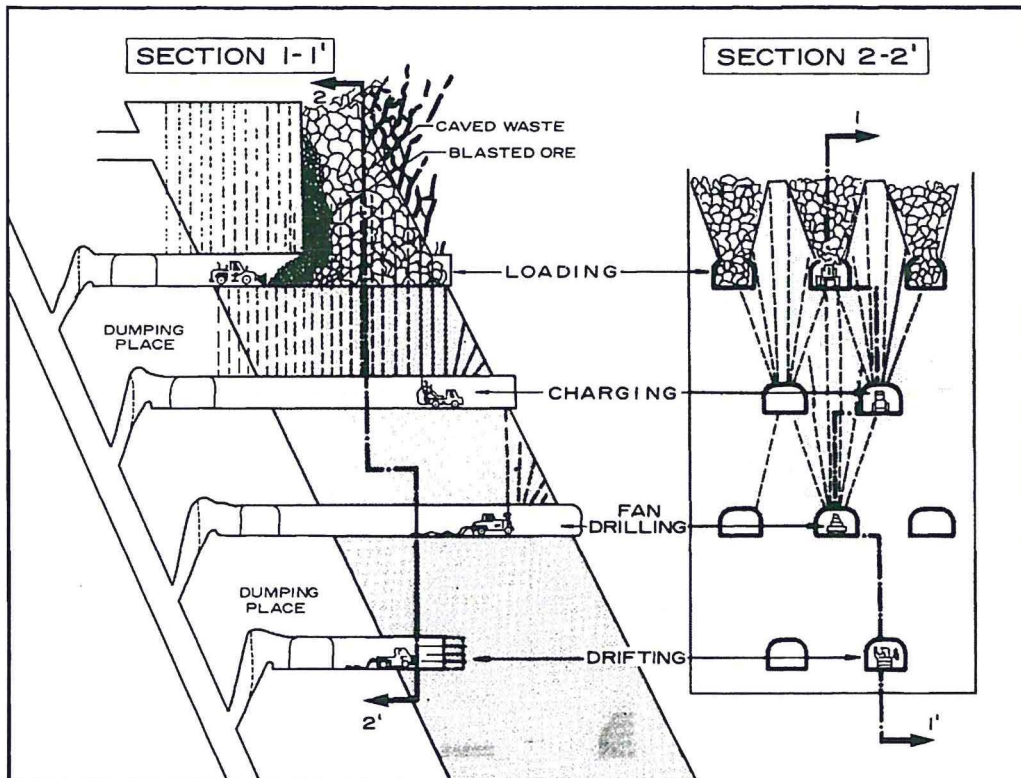
Question 7

A mine has a zinc deposit that is being mined with a target of 20 000 tonnes of ore per month, with an open stope mining method. The stope is on average 15m wide and inter-level spacing of 45m. Longitudinal mining is being executed with the length of the stope being around 150m long. Rings are planned with a burden of 1.5m and spacing 2.m. If blasting is done once every week to meet production and specific gravity of 2.5 can be applied.
  a) Draw the section of the mining method (4 marks)
  b) Compute stope Volume (2 marks)
  c) Compute the stope, and the ring tonnages (3 marks)
  d) The number of rings that must be blasted every week (3 marks)
  e) How long does the stope last before it is mined out? (3 marks)

f) The cross cut to the loading bay is 1 km long and it takes 10 minutes cycle time for LHD with 3.5 m³ bucket to travel. A 20-tonne truck takes 30 minutes cycle time to haul material to surface. Would the two pieces equipment meet the production target if you have three shifts of 8 hours? (12 marks).

Question 8

Discuss the mining method shown in the picture below, in sub areas of suitability of mining method, how development, and production is undertaken. (15 marks)

Queuing Model, Single Server Formulas

$$P_o = \text{Prob}\begin{bmatrix} \text{system is} \\ \text{empty (idle)} \end{bmatrix} = 1 - \frac{\lambda}{\mu}$$

$$L_q = \frac{\text{average number}}{\text{in the queue}} = \frac{\lambda^2}{\mu(\mu - \lambda)}$$

$$L = \frac{\text{average number}}{\text{in the system}} = \frac{\lambda}{\mu - \lambda}$$

$$W_q = \frac{\text{average time}}{\text{in the queue}} = \frac{\lambda}{\mu(\mu - \lambda)}$$

$$W = \frac{\text{average time}}{\text{in the system}} = \frac{1}{\mu - \lambda}$$

Note:

λ is the arrival rate.

μ is the service rate.