NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF ENGINEERING AND THE BUILT ENVIRONMENT

DEPARTMENT OF MINING AND PROCESS ENGINEERING

QUALIFICATION : BACHELOR OF ENGINEERING IN MINING ENGINEERING	
QUALIFICATION CODE: 08BMIN	**LEVEL: 7**
COURSE CODE: DBS721S	**COURSE NAME: DRILLING AND BLASTING 323**
SESSION: NOV 2022	**PAPER: THEORY**
DURATION: 3 HOURS	**MARKS: 100**

FIRST OPPORTUNITY EXAM PAPER	
EXAMINER(S)	**Mr L. Madziwa**
MODERATOR:	**Mr P. Shava**

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
2. Scientific calculator

THIS QUESTION PAPER CONSISTS OF 6 PAGES (Including this front page)

Question 1 [20 marks]

a) What are the effects of the delay timing and the initiation sequence of a blasting are not adequate? [4]

b) Blast designs are undertaken using controllable and uncontrollable factors. Describe how five key controllable factors and five uncontrollable factors affect blast designs. [10]

c) Explain how drillhole diameter, burden and powder factors variables affect fragmentation. [6]

Question 2 [12 marks]

A blast round was designed in a way that the diameters of the drilled holes were 50 mm, 75mm and 115mm with spacing to burden ratio 1:2. The bench height was determined by the length of the drill rods coupled together which are 3 meters each. 0.45 m deviation was recorded after using four of those drill rods. If rock constant is 10, and the density of the ANFO is 900kg/m^3.

a) Determine the loaded length, quantity of explosives and powder factor required for the three-hole diameters, taken the mean fragment size to be 30 cm, L is the loaded length above the toe, J is the hole stemming, H is the bench height, D is the diameter of drilled hole and S_{ANFO} is relative specific weight of ammonium fuel oil. Calculate the loaded hole length of explosive, the quantity of explosive as well as powder factor? Each parameter carries one mark.

Hole diameter, D (mm)	Charge Length, L (m)	Amount explosives, Q_e (Kg/hole)	Powder factor, K (Kg/m^3)
50	.....	.....	.....
75	.....	.....	.....
115	.....	.....	.....

b) Draw your conclusion from the answers in (a) [3]

Question 3 [14 marks]

The open pit mine has massive fine-grained lava with a skarn gold mineralization and there is little jointing closer than anticipated drilling pattern. The mine management has requested you as a mining engineer to determine the rock factor. The massive grained lava rock has the following data:

UCS = 500MPA, Young's Modulus = 80 GPa

Density = 2.8 t/m , RDM =50, J=0

Determine the following;

a) Rock density influence (RDI) [2]
b) Hardness factor (HF), [2]
c) Rock Factor (A) [3]

Question 4 [20 marks]

In blasting operations, drilling, and how explosives are charged, and the quantity of explosives used are major contributors to the output of a blast.

a) Outline the effects of fragmentation on drilling, blasting, loading and hauling cost? [4]

b) Explain what you understand by the term initiation system in blasting. [2]

c) Explain what you understand by the term initiation sequence in blasting. [2]

d) Why is hole orientation important in drilling? [2]

e) Define cushion blasting using open pit mining and underground mining example. [4]

f) What is smooth wall blasting? [2]

g) What is pre-splitting? [2]

h) What is post-splitting? [2]

Question 5 [14 marks]

If a mine drift is to be excavated in rock (c =0.4) by means of blasts with parallel blast holes and four sections cut, knowing that the geometric dimensions and drilling data are:

- Tunnel width AT =4.5 m
- Abutment height = 4.0m
- Height of arch =0.5 m
- Relief hole diameter D_2 = 102mm
- Drilling diameter D_1 =45mm

The explosive to be used has a Relative Weight Strength with respect to ANFO of 1.09 (109%) and the available cartridges have diameter of 25, 32 and 38mm, which give lineal charge concentrations for density of 1.2 g/cm³, of 0,59, 0.97, and 1.36 kg/m respectively.

a) You require to determine the advance per round blasted, the development tunnel is about 60m, how many advances do you need to complete this tunnel? [6]

b) Calculate your first, second, third and fourth section quadrangle cut? [8]

Question 6 [20 marks]

B&E Mining and Development contract has been awarded a contract for underground tunnel development. The contractor has requested you as mining engineer to determine certain parameters for their underground tunnel development. Some of the known parameters are as follows:

- Tunnel height = 6.5 m
- Targeted powder factor = 1.7 kg/m³
- 28 perimeter holes loaded with 0.5 kg load.
- The chosen burn cut requires 7 loaded holes with 2.8 kg load.
- Blasthole load weight =5.5 kg/hole
- The round length = 3.4m

Calculate the following;

a) Round volume (V), [4]

b) Total Explosive weight (TW), [4]

c) Blasthole weight (BW), [4]

d) The cut weight (CT), and [4]

e) The number of blastholes (N). [4]

End of Examination

Important formulae for DLB 721S – 2022

1. $$K_{act} = \frac{(L + U) * M_c}{B * S * H}$$

2. $$B = 0.012\left(\frac{2SG_E}{SG_R} + 1.5\right) \times D_E$$

3. $$M_c = \frac{C}{100} * \frac{\rho * d^2}{1273}$$

4. $$B = \sqrt{\frac{LM_c}{aHK_{tech}}}$$

5. $$V = \frac{\pi D^2}{4} xRD$$

6. $$Q = \frac{\pi}{4}\frac{d}{1000}\rho$$

7. $P = 5.7 \times 10^{-5} \times (RF - 28 \times \log(0.145 \times S_c)) W/Ø \times RPM$

$$P = (61 - 28\log_{10} S_c)\frac{W}{\phi} \bullet \frac{rpm}{300}$$

7.a.

$Um = 264p^{½}d^{½}$

Where: d = diameter of the chip in inches
p = density of chip in Ib/ft3

8.

9. $$VM = 2 * VP^{0.65} = 2 * 50^{0.65} =$$

10. RDI = 25*RD-50=25*2.8-50 = 20

11. HF = UCS /5 =500/5=100

12. Rock Factor (A) = 0.06(RMD+JF+RDI+HF) =0.06(50+ 20+100) =10.2

13. $P = 2.5 \times \rho v^2 \times 10^{-6}$