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#### MANICALAND STATE UNIVERSITY OF APPLIED SCIENCES

**FACULTY OF ENGINEERING, APPLIED SCIENCES AND TECHNOLOGY**

**DEPARTMENT: MINING AND MINERAL PROCESSING ENGINEERING**

**MODULE: ROCK BREAKING**

**CODE: ENGP326**

**SESSIONAL EXAMINATIONS**

**JUNE2023**

**DURATION: 3 HOURS**

**EXAMINER: M.S. KANONGOVERE**

## INSTRUCTIONS

1. *Answer any* ***FIVE*** *questions.*
2. *Each question carries 20 marks,*
3. *Start a new question on a fresh page*
4. *Total marks 100*
5. *Additional materials: calculator, graph paper*

**QUESTION 1**

1. Analyze the fragmentation distribution for a quarry which has a bench height of 14m. The burden and spacing are set at 7 and 9 metres respectively. The column charge will be ANFO of density of 0.8g/cm3 which ha a RWS OF 100 .

|  |  |
| --- | --- |
| Hole diameter | 102mm |
| Bench height | 14m |
| Burden  | 3.0m |
| Spacing  | 3.6m |
| Stemming length | 2.2m |
| Sud drill | 0.9m |
| Technical powder factor | 0.6kg/m3 |
| Drilling accuracy | 0.2m |
| Rock factor | 10 |

Determine

1. The mean fragmentation **[5]**
2. The uniformity index **[2]**
3. The cumulative percentage for size distribution **[10]**

|  |  |
| --- | --- |
| **Size distribution**  | **Cumulative % passing** |
| **0** |  |
| **20** |  |
| **40** |  |
| **60** |  |
| **80** |  |
| **100** |  |
|  |  |
|  |  |

**iv)** neatly sketch a graph of cumulative % passing against size distribution **[3]**

**QUESTION 2**

**a**) Given that ANFO loaded at a density of 0.85g/cm3 has an Absolute Weight Strength (AWS) of 850cal/g, determine the Relative Weight Strength (RWS) of an explosive A which has an Absolute Bulk Strength (ABS) value of 980cal/cm3 at a density of 1.25g/cm3**. [6]**

1. Sketch and label an electronic detonator and describe how it works**. [5]**
2. Define burning front and with a well labelled diagram illustrate the burning front if a blaster decides to initiate blastholes using Uni-Delay shock tubes without-hole detonators (200ms) and in-hole detonators (4000ms). **[5]**
3. Define detonation and deflagration**. [4]**

**QUESTION 3**

1. Describe any two tests that can be done to test the safety in handling of an explosive **[6]**
2. By means of a graph illustrate and describe briefly, how the mining costs are influenced by fragmentation **[4]**
3. An underground mine is to drill 75mm diameter drill holes to depth to a depth of 3.2m and charge them with pumpable sensitized emulsion of density 1.20g/cc. If a powder of 0.75kg/m3 is to be utilized, what will be ring burden and toe spacing if the holes are expected to break to their full depth.

Assume S/B = 1.25 **[6]**

1. Discuss any two specialized blasting techniques with the aid of diagrams that are used in mining operations to control blast overbreaks and maintaining a smooth wall **[4]**

**QUESTION 4**

1. With the aid of sketches, Discuss the interaction between rock and explosive detonation process **[10]**
2. A major factor that determines the fragmentation distribution of a blast is the powder factor. Explain how changes in the fragmentation distribution produced by changing the powder factor of a blast affects the cost of :
3. Drilling
4. Explosives and initiation system
5. Loading
6. Hauling
7. Crushing **[10]**

**QUESTION 5**

1. Discuss the C-J and ZND theory of detonation. **[10]**
2. Compute the Oxygen balance of ANFO at composition of 93% for Ammonium Nitrate and 7% Fuel Oil. **[6]**
3. Outline the mechanics of rock breaking. **[4]**

**QUESTION 6**

1. Discuss any 5 properties of explosives **[10]**
2. Electric detonators can be connected in 3 ways, with the aid of diagrams, describe these connections and mention the advantages and disadvantages of each type of connection **[7]**
3. Discuss the theory of detonation as described by Chapman and Jouquet **[3]**

equations

n= ($2.2-14 .\frac{B}{D}$ )( 1 -$ \frac{W}{B}$ )**.**$ (\frac{1+ \frac{S}{B}}{2}$ )0.5 **.** (absI$\frac{BCL-CCL}{L}$ I + 0.1)0.1 $\frac{L}{H}$

$x$50 = A **.** K -0.8**.** Q0.167**.** $\left(\frac{115}{E}\right)$0.633

R = 1 - $e^{-0.693(\frac{X}{X50})} $n