



**FACULTY OF ENGINEERING AND ENVIRONMENT**

**DEPARTMENT OF MINING ENGINEERING**

**EXPLOSIVES ENGINEERING**

**EMN 2109**

**Final Examination Paper**

**September 2024**

This examination paper consists of 3 pages

**Time Allowed: 3 hours**

**Total Marks: 100**

**Examiner's Name: MS C MACHADU**

**INSTRUCTIONS**

1. Answer **ALL FOUR (4)** questions
2. Each question carries **25** marks

**Additional Requirements**

Calculator

**MARK ALLOCATION**

<b>Question 1 to 4</b>	<b>Total 25 marks each</b>
<b>Part Questions</b>	<b>As shown in each part question</b>
<b>Total Attainable</b>	<b>100 marks</b>

### QUESTION 1

- a) Detonators or capped fuses may be stored or carried together with other types of explosives under what circumstances? (state any 3) [3]
- b) What are the 5 main ingredients used in the manufacturing of explosives and give an example for each? [10]
- c) You are an employee at INTRACHEM, explosive manufacturing company. Mimosa Mine, one of your largest clients has contacted you to deliver some explosives today. As part of the Explosives Regulations you are compelled to record some information. List details that are to be included in this record [7]
- d) List any 5 properties one should consider upon purchasing explosives. [5]

### QUESTION 2

- a) What is an explosive? [3]
- b) Outline the difference between blast design and drill pattern. [3]
- c) As a rule of thumb, what is the proportion of stemming in relation to the depth of the blast hole? [1]
- d) Fill in the table below. Include percentage ratios where necessary. [10]

<b>Explosive</b>	<b>Description and use</b>	<b>Ingredients</b>
Prilled ANFO		
Heavy ANFO		
Bulk emulsion		
Pre-packed emulsion		
Gun powder		

- e) Prior to charging, why is it necessary to do the following:
  - i. Measure the depth of all holes.
  - ii. Identify and record hot holes.
  - iii. Identify and record wet holes.

- iv. Remove swarf on the collar of the drill hole. [8]

### QUESTION 3

- a) What material is used for stemming and give 3 reasons stemming is done. [5]
- b) State 5 hazards associated with drilling and blasting, and give mitigation measures for each. [10]
- c) ANFO has a velocity of detonation (V.O.D) of 4500m/s and a density of 0.85 kg/m<sup>3</sup>. Calculate the explosive pressure. [2]
- d) The specific gravity (s.g.) of coal is 1.3. Using a burden and spacing of 6.2m and 7.1m respectively, and an average depth of 8m. Calculate the following:
- The tonnage of coal blasted on a bench with 85 holes. [5]
  - Number of holes to be drilled to reach a target of 85 000 tonnes of coal. [3]

### QUESTION 4

- a) Sandstone bench of 165 holes with an average depth of 15m and is to be blasted. Given that a burden and spacing of 2m and 2.3m respectively, are used during pre-splitting. Calculate the following:
- Calculate the expected volume of material to be blasted. State all assumptions made and justify the burden and spacing you have used in this calculation. [5]
  - Calculate the amount of ANFO required for this blast given that a powder factor of 1.15kg/m<sup>3</sup> is used. [3]
- b) Given that ANFO and bulk emulsion have an s.g of 0.85 and 1.2 respectively calculate the metre rise for each if :
- A drill bit with a diameter of 19.1cm is used. [3]
  - A drill bit with a diameter of 17.1 cm is used. [3]
  - Compare your answers in (i) and (ii) and comment. [2]
- c) Give 3 types of:
- Drill bits used in mining [3]
  - Materials used in the fabrication of drill bits [3]
  - Drill patterns used in subsurface mines [3]