



FACULTY OF ENGINEERING AND THE ENVIRONMENT

DEPARTMENT OF MINING ENGINEERING

EXCAVATION ENGINEERING

EMI 2103

Final Examination Paper

January 2021

This examination paper consists of 3 pages.

**Time Allowed:** 3 hours

**Total Marks:** 100

**Examiner's Name:** Eng Murewa B Zvigumbu

**INSTRUCTIONS**

1. Answer **all** questions.
2. Each question carries **20 marks** each.

**Additional Requirements**

Scientific calculator.

**MARK ALLOCATION**

Questions	Marks
Question 1	20
Question 2	20
Question 3	20
Question 4	20
Question 5	20
Total Attainable	100

### **Question 1: Mine Power Systems**

- a) Discuss merits and demerits of hydraulic power systems in mining machinery [10 Marks]
- b) Discuss with aid of sketches the difference between open and closed hydraulic circuit system. [10 Marks]

### **Question 2: Mechanical excavation.**

- a) What are geo-engineering properties of rocks influencing rock excavation? [5 Marks]
- b) Explain drillability of rocks. [2 Marks]
- c) How is drilling penetration used for a blast design? [3 Marks]
- d) What are the problems faced in underground drilling. [10 Marks]

### **Question 3: Mechanics of impact breaking, Rock Drilling & Explosives**

- a) Write short notes on the following:
- (i) Emulsion explosive. [2 Marks]
  - (ii) Non electric initiation. [2 Marks]
  - (iii) Critical diameter of explosives. [2 Marks]
  - (iv) Computer-controlled Jumbo Drilling machine. [4 Marks]
- b) Complete the table below to describe the composition, physical properties, state advantages, disadvantages and applications of the following:
- |          |           |
|----------|-----------|
| ANFO     | [5 Marks] |
| SLURRIES | [5 Marks] |

#### Question 4: Rock Breaking and Blasting Applications

Define the following terms and briefly discuss with aid of sketches appropriate.

- a) Hydrodynamic theory of detonation. [5 Marks]
- b) Ideal and non-ideal blasting. [5 Marks]
- c) Ground Vibrations [5 Marks]
- d) Air blast [5 Marks]

#### Question 5: Underground Blasting & Tunnel Boring Machines & Surface Mining Blasting

- a) With respect to Tunnel Boring Machines (TBM)
  - (i) Explain the selection criteria. [4 Marks]
  - (ii) List the problems generally encountered during tunnel boring. [4 Marks]
  - (iii) State two types of mechanical raising. [2 Marks]

b) A surface coal mine currently in operation plans to undertake additional blasting loading ANFO with a density of 0.8 g/cm<sup>3</sup>. Additional relevant parameters with respect to this proposed shot are:

• Burden	=	<b>8.5m</b>
• Spacing	=	<b>10.1m</b>
• Bench height (or hole depth)	=	<b>41.2m</b>
• Hole diameter	=	<b>280mm</b>
• Stemming	=	<b>9.1m</b>
• No. of holes	=	<b>200</b>
• Insitu Density of Coal	=	<b>1.495 t/m<sup>3</sup></b>

- (i) Determine the insitu volume from additional production panel? [2 Marks]
- (ii) ANFO loaded per hole what is the linear charge density? [2 Marks]
- (iii) If the round blast right down to the toes, what is the additional loose volume of coal given the swell factor is 32%? [2 Marks]
- (iv) Calculate the powder factor in 4 variants of powder factor? [4 Marks]

\*\*\*\*\* THE END \*\*\*\*\*