FACULTY OF ENGINEERING AND ENVIRONMENT

DEPARTMENT OF MINING ENGINEERING

EXCAVATION ENGINEERING EXAMINATION

EMI 2103

Final Examination Paper

June 2020

This examination paper consists of 4 pages

Time Allowed: 3 hours

Total Marks: 100

Examiner's Name: Eng Murewa B Zvigumbu

INSTRUCTIONS

1. Answer **ANY FIVE** 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
Question 6	20
Total Attainable	100

SECTION A

Question 1: Mine Power Systems

a) Discuss with aid of sketches the distribution of power in underground coal mine. **[10 Marks]**

b) A coil takes a current of 6 A when connected to a 24-V d.c. supply. To obtain the same current with a 50-Hz ac. supply, the voltage required was 30 V. Calculate

(i) Inductance of the coil **[2 Marks]**

(ii) Power factor of the coil. **[3 Marks]**

c) Discuss how power correction with capacitors reduces cost in an electrical mine system.

[3 Marks]

d) Briefly explain the advantages of load analysis in managing a mine electrical system.

[2 Marks]

Question 2: Mechanical excavation.

a) Sketch and describe the construction of a COPROD Drilling machine. **[8 Marks]**

b) State and explain the main purpose of drilling in mining. **[4 Marks]**

c) Briefly explain choice of drilling equipment and generally factors that influence. **[2 Marks]**

d) State the types of drilling mechanism. **[4 Marks]**

e) What is the difference between a shank adaptor and chuck? **[2 Marks]**

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

a) Differentiate between the following:

(i) Low explosive and high explosive. **[2 Marks]**

(ii) Dry blasting agent and wet blasting agent. **[2 Marks]**

(iii) Safety fuse and detonating fuse. **[2 Marks]**

(iv) Detonation and deflagration. **[2 Marks]**

(v) Primary and secondary blasting. **[2 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]**

CATEGORY	**ANFO**	**SLURRIES**
Composition		
Physical properties		
Advantages		
Disadvantages		
Applications		

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

a) With respect to Tunnel Boring Machines (TBM)

(i) List those factors affecting TBM performance. **[3 Marks]**

(ii) Give a line diagram to depict a general classification of tunneling methods that are used under different situations including varying ground conditions **[4 Marks]**

(iii) Discuss the merits and limitations of the rapid drive work with the application of TBM.

[3 Marks]

b) A coal seam 3.0 m thick is being mined using drilling and blasting on a square pattern. The hole burden and spacing used are **1.2m** each, respectively. The drill holes are drilled to a depth of 3.6m each. An explosive, coalex of density 1.32 **g/cm^3** is used to charge the holes. This explosive comes in 32*200 capsules and a **25 kg** case of coalex explosive has a nominal count of **125** capsules. Density of coal is 1450 kg/m^3.

(i) How many holes do you expect to find on a 15m production panel? **[2 Marks]**

(ii) If 12 ticks are loaded per hole what is the linear charge density? **[2 Marks]**

(iii) What is the stemming length per hole? **[2 Marks]**

(iv) Calculate the powder factor in 4 variants of powder factor? **[2 Marks]**

(v)If the round blast right down to the toes, what volume of muck pile is generated assuming a swell factor of 1.3? **[2 Marks]**

Question 6: Surface Mining Blasting

a) In an open pit limestone mine during bench blasting, the spacing used is 1.25 times the burden and a burden of 5 m is kept. If bench height is 11 m and 50 holes are to be blasted,

(i) Calculate the tonnage of limestone yield if its density is 2.9 t/m3. **[3 Marks]**

(ii) Calculate the powder factor if explosive charged in all holes is 3000 kg. **[3 Marks]**

(iii) Also calculate the limestone that will be yielded per hole. **[4 Marks]**

b) (i) Discuss the factors that affect the magnitude of vibration. **[5 Marks]**

(ii)United State Bureau of Mines (USBM) concluded that ground vibration is given by the following equation

$$v = K[R/\sqrt{Q}max]^{-B}$$

Define the variables v, K, R, Q_{max} and B **[5 Marks]**

********** **THE END** **********