#### MANICALAND STATE UNIVERSITY

#### OF

#### APPLIED SCIENCES

FACULTY OF ENGINEERING

**MINING AND MINERAL PROCESSING ENGINEERING DEPARTMENT**

**MINE VENTILATION**

**CODE: HMIE 511**

### SESSIONAL EXAMINATIONS

**MAY 2019**

**DURATION: 3 HOURS**

**EXAMINER: B. MUTIZHE**

## INSTRUCTIONS

1. *Answer* ***all*** *questions in Section A*
2. *Answer any* ***three*** *questions from section B*
3. *Each question carries 20 marks*
4. *Total marks 100*

**Section A**

**Question 1**

You are in charge of developing a ventilation system for an underground mine, which is at its design stage. However, there are three alternatives for supply of air to 3000 m long cross-cuts which are to circulate about 400 m3s-1 of air and an economic alternative has to be selected from the following options;

**Option 1**

* Cross-cut 4 m x 3 m
* K = 0.0098 n2m-4
* Cost (ventilation fan) = US$ 500/m

**Option 2**

* Cross-cut 4 m x 3.3 m
* K = 0.0098 n2m-4
* Cost (ventilation fan) = US$ 600/m

**Option 3**

* Cross-cut 2.8 m x 2.5 m
* K = 0.0098 n2m-4
* Cost (ventilation fan) = US$ 5400/m

**Assumptions:**

* The cost of power 14 c/kwh
* Fan efficiency 80%
* Motor efficiency 90%
* Safe Rate of Interest 4%
* Present value factor 9.39%

Which one is the economic option? **[20]**

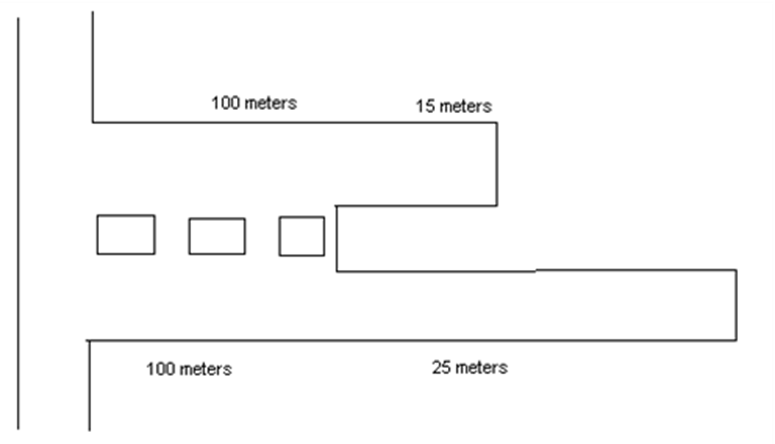
**Question 2**

1. Arrange **six** common gases found in underground operation in order of their increasing solubility, maximum permissible quantity and specific gravity. **[7]**
2. Group the gases into toxic and poisonous gases and arrange them in their increasing order toxic and poisonous. **[3]**
3. Briefly explain the difference between centrifugal fans and axial fans. **[3]**
4. What is a system resistance curve? Discuss how change in air density and fan speed affects the system curve. **[7]**

**Section B**

**Question 3**

1. Fig. 1 shows two decline shafts which are being sunk at the same time (simultaneously). The declines are parallel dipping at 100. Pillars of 3 m x 5 m are left behind as support. Can you ventilate these two declines using force exhaust overlap system? **[10]**

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**Fig. 1**

b)

1. Briefly describe methods used to measure the following ventilation parameters in underground working.
2. Velocity
3. Pressure
4. Dust

**[10]**

**Question 4**

1. Define Natural Ventilation and give two factor lead to flow of air due to Natural Ventilation. **[3]**
2. Consider two shafts having an equal diameter of 7 m and sunk to a depth of 500 m. The two shafts are connected at the bottom by a level of 4 m x 3 m in cross section and 1200 m long. Calculate the average velocity of flow in the level due to natural ventilation if the average barometric pressure in the shaft is 110.27 Kpa.

***Given data:***

Temperature in D/C shaft top 287K

Temperature in D/C shaft bottom 293K

Temperature in U/C shaft top 300K

Temperature in U/C shaft bottom 300.5K

The coefficient K for the shafts is 0.005 NS2m-4 and the levels 0.012 NS2m-4. Neglect shock losses. **[17]**

**Question 5**

1. With the aid of diagrams explain the effect of connecting two similar fans in
   1. Series
   2. ii. Parallel **[6]**
2. Briefly explain air recirculation. **[4]**
3. Design a ventilation system that is used in ventilating the development end shown in Fig 2. What are the *advantages* and *disadvantages* of each of the systems? Illustrate your answer using diagrams. **[10]**

*40m*

*Drive*

**Fig. 2**

**Question 6**

1. An airway splits into ventilation district A, B and C. The ventilation district airway have the following attributes;

*Airway (A)*  *Airway (B)* *Airway (C)*  
Width 6 m 6 m 8  
Height 7 m 3 m 9  
Length 200 m 300 m 150m  
K factor 0,01 0,08 0.04  
***QTotal = 80 m3/s = QA + QB + QC  
ω = 1,3 kg/m3***Calculate the pressure drop in ventilation district A, B and C and quantities QA , QB, QC respectively.**[13]**

1. Design an experiment to measure the fan operating point in underground working. **[7]**

**END OF QUESTION PAPER**