FACULTY OF ENGINEERING AND THE ENVIRONMENT

DEPARTMENT OF MINING ENGINEERING

MINE VENTILATION PRACRICE

EMI 3110

Final Examination Paper

November 2023

This examination paper consists of 4 pages

Time Allowed: 3 hours.

Total Marks: 100

Examiner's Name: Mr A Antonio

INSTRUCTIONS

1. This paper contains **ONE** section with **FIVE** questions.
2. Answer any **FOUR QUESTIONS**.
3. Each question carries 25 marks.
4. Where a question contains subdivisions, the mark value of each subdivision is shown in brackets.
5. Illustrate your answer, where appropriate, with large clearly labelled diagrams.
6. Start each question on a new page.
7. This paper comprises 4 printed pages.

Additional Requirements

Calculator

QUESTION ONE

When considering the physiological effects of dust, a classification of dust with respect to potential hazards to the health and safety of industrial workers may be divided into five categories. Write brief notes on the following dust categories:

   i.   Toxic dust
  ii.   Carcinogenic (cancer-causing) dust
 iii.   Fibrogenic dusts
 iv.   Explosive dust
  v.   Nuisance dust   **[25 Marks]**

QUESTION TWO

  a. Heat can be a major problem in underground mines. Briefly describe five major sources of heat in an underground mine.   **[10 Marks]**

  b. Workers are complaining about high temperatures in their workplaces and your ventilation surveys have proven beyond reasonable doubt that the heat is unbearable. Describe two remedial actions that you will recommend to improve the situation.

                                  [10 marks]

  c. What are heat cramps, and what are the common signs and symptoms associated with this condition?   **[5 marks]**

QUESTION THREE

  a. Briefly describe:
      i.   Natural Ventilation,
     ii.   Forced and exhaust ventilation.   **[10 Marks]**
  b. State the merits and demerits of centrifugal and axial flow fans for their applications in mines**.**   **[5 Marks]**
  c. Explain what you understand by fan and mine characteristics.   **[5 Marks]**
  d. Describe the fan laws.   **[5 Marks]**

QUESTION FOUR

a. Consider a concrete-lined shaft 91.44m deep, 5.49 m in diameter, and moderately obstructed. Calculate the Pressure loss if a quantity of 188.78 m3/s is flowing in the shaft.   Assume K = 0.0065kg/m3   **[6 Marks]**

b. Consider a roadway 731.52 m long with an area of 8.36 m2 and a perimeter of 12.19m. A pressure loss of 373.26Pa is measured when the airflow is 25.29 m3/s. Calculate and comment on the friction factor for the roadway.

[6 marks]

c. Given 3 airways, 1, 2, and 3 in series, Q = 9.44m3/s with pressure drops P1 = 497.68Pa, P2 = 248.84Pa and P3 = 746.52Pa find Q, P, and R.   **[6 Marks]**

d. Given the three airways in the previous question with resistances R1 = 5.585, R2 = 2.793, and R3 = 8.378 in N-s2/m8), arranged in parallel, with the total Q = 47.195 m3/s.

Find systems P and R and the quantities Q1, Q2, and Q3.   **[7 marks]**

QUESTION FIVE

a. Discuss the following ventilation surveys normally carried out on a mine:
   i.   Air quantity survey.
   ii.   Temperature – humidity survey.
   iii. Pressure survey.

   In each case, state the instruments used and the importance of the results obtained from each survey.   **[10 Marks]**

b.   What is a Respiratory Quotient?   **[1 Mark]**

The Respiratory Quotient and oxygen consumption for a normal man for different activities are given as follows:

Activity	Oxygen Consumption m^3/s	RQ
At rest	4.72×10^{-6}	0.75
Moderate Work	3.3×10^{-6}	0.90
Vigorous Work	4.72×10^{-5}	1.0

Given that the percentage of oxygen in the intake air is 21% and 19.5% in the exhaled air.

i.   Calculate the quantity of air to be supplied to 10 men doing moderate work underground using oxygen as an indicator.   **[6 Marks]**

ii.   Calculate the quantity of air to be supplied to 10 men doing moderate work underground using the RQ.   **[6 Marks]**

iii.   Comment on the difference between your two answers above.

                                                                           [2 Marks]