B.E/B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, MAY 2010
MINING ENGINEERING BRANCH,IIT KHARAGPUR
FOURTH SEMESTER – (REGULATIONS – 2008)

MI – 9252 MINE ENVIRONMENTAL ENGINEERING - I

Time: 3 hr Max Mark: 100

Answer ALL Questions
PART A (10 x 2 = 20 Mark)

1. Explain the term 'Lag on ignition'. How is it influenced by temperature?
2. What are the factors that decide the height of the cap in flame safety lamp?
3. What are the various methods of detection of CO?
4. What is meant by 'mixing ratio'?
5. What are the effects of high air velocity on the miner?
6. How does temperature affect Natural Ventilation in Mines?
7. How does splitting of air current improve mine ventilation?
8. Explain 'Resistance coefficient'.
9. What is the pressure required to circulate a quantity of 1000 m^3min^{-1} through a roadway of size 3.0 m x 3.0 m in size having a 'k' value of 0.0001 Ns^2m^{-4} for 200m length of the roadway.
10. Distinguish between 'Homotropal' and 'Antitropal' ventilation systems.

PART B (5 x 16 = 80 Mark)

11. Explain how resistance of mine airways is determined from fundamental pressure loss equation. How are resistances evaluated for airways in series and parallel?

12. a i) What is firedamp? Explain its occurrence in underground coal mines (8).
    ii) What is 'Migration of Methane'? Describe the factors that control the emission of methane from coal face (8)

OR

12 b. i) Describe the poisonous nature of carbon monoxide. What are the physiological effects of carbon monoxide poisoning at various concentrations. (8)
ii) With a neat diagram explain the principle of operation and working of 'Hoolamite tube' (8).

13. a. i) Explain the various ways of expressing moisture content of mine air. (8).
    ii) What are wet bulb and dry bulb temperatures? Explain the working of fixed or Non- ventilated hygrometer (8)

OR

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13 b. Explain the various effects of high heat and humidity on the miner.

14. a i) Explain the various causes of 'natural ventilation' in underground mines (6)
ii) Describe the change in the direction of natural ventilation during summer and winter. How is natural ventilating pressure calculated from air densities? (10)

OR

14 b i) Two parallel splits A and B have a pressure of 400 Pa acting across them, causing a flow of $20 m^3 s^{-1}$ in split A and $15\ m^3 s^{-1}$ in split B. It is desired to reduce the quantity in split A to $15\ m^3 s^{-1}$ by placing a regulator in it. Calculate the size of the regulator and the quantity in split B after regulation if the surface fan pressure is 2 kPa (12)
ii) A 400m long airway passes $15\ m^3 s^{-1}$ of air. A new airway of similar cross section and surface characteristics of 300m length is added parallel to it. Calculate the quantity passing through the new airway as well as total quantity assuming air pressure to remain constant (4).

15 a. i) A mine airway 3m high and 4.5m wide has a bend with an angle of deflection of 30^0 and radius of curvature of 30m. Calculate the shock factor for the bend, shock pressure loss and the shock resistance. The air velocity in the roadway is $2\ ms^{-1}$ and the air density is $1.2\ kgm^{-3}$. (6)
ii) A combination of mine roadways has a same pressure drop of 200 Pa and the resistances of each roadway are $0.3\ Ns^2m^{-8}$, $0.8\ Ns^2m^{-8}$ and $0.9\ Ns^2m^{-8}$. Calculate the combined resistances of the roadways and also the quantity flowing through each roadway (6).
iii) Determine the nature of flow in a mine airway of 2.0 m width and 3.0m height if the velocity of the air is $1\ ms^{-1}$. Assume the value of kinematic viscosity as $0.000015\ m^2 s^{-1}$ (4)

OR

15.b i) Explain the principle of Air cycle refrigeration systems for cooling deep mines (6)
ii) With diagrams explain the boundary and central systems of ventilation (10)