GUJARAT TECHNOLOGICAL UNIVERSITY

BE 6 SEMESTER – OLD PAPER – S22 TO S26 – QUESTION BANK

Subject Name & Code: Mine Ventilation - 3162207

Chapter 1: Composition of mine atmosphere

Repeated Questions:

1. Composition of Mine Atmosphere and Damps:

- **Q.** Discuss the composition of mine atmosphere. **(SUMMER 2022, 3 Marks; SUMMER 2024, 3 Marks; SUMMER 2025, 3 Marks)**
- **Q.** List out different types of damps in underground mines with their composition of gases. / Enlist different types of damps in underground mines with their composition of gases. **(SUMMER 2022, 4 Marks; SUMMER 2024, 4 Marks; SUMMER 2025, 4 Marks)**
- **Q.** What do you understand by blackdamp? / What is blackdamp? Explain briefly. **(WINTER 2023, 3 Marks; WINTER 2024, 3 Marks; SUMMER 2026, 3 Marks)**
- **Q.** Write the Salient points of Coward's Diagram with neat sketch. [Diagram required – refer to the original question paper] **(WINTER 2022, 4 Marks; WINTER 2023, 4 Marks; WINTER 2024, 4 Marks; SUMMER 2026, 4 Marks)**

2. Hazardous Gases: Properties and Physiological Effects:

- **Q.** Why carbon monoxide gas is considered as the most dangerous gas in mines? Explain its detection process and physiological effect. / Discuss the physiological effect and detection of carbon monoxide gas in mines. / Describe characteristics, properties and their physiological effect of Carbon Monoxide (CO). **(SUMMER 2022, 7 Marks; WINTER 2023, 4 Marks; SUMMER 2024, 7 Marks; WINTER 2024, 7 Marks; SUMMER 2025, 7 Marks; SUMMER 2026, 3 Marks; SUMMER 2026, 7 Marks)**
- **Q.** Describe characteristics, properties and their physiological effect of Methane (CH_4). **(SUMMER 2022, 7 Marks OR; SUMMER 2024, 7 Marks OR; SUMMER 2025, 7 Marks)**

3. Gas Detection and Detectors:

- **Q.** Explain about Firedamp in details with its detection by flame safety lamp. / How firedamp is detected by using flame safety lamp? / Explain flame safety lamp and its uses. **(SUMMER 2022, 4 Marks; WINTER 2022, 4 Marks; SUMMER 2023, 3 Marks; WINTER 2023, 7 Marks; WINTER 2023, 4 Marks; SUMMER 2024, 4 Marks; WINTER 2024, 4 Marks; SUMMER 2025, 4 Marks; SUMMER 2026, 7 Marks)**
- **Q.** Explain PS detector, Hopcalite detector and Hoolamite tube. **(SUMMER 2022, 7 Marks; SUMMER 2024, 7 Marks; SUMMER 2025, 7 Marks)**
- **Q.** Explain principle of Wheatstone bridge with neat sketch. [Diagram required – refer to the original question paper] **(SUMMER 2022, 7 Marks OR; SUMMER 2024, 7 Marks; SUMMER 2025, 7 Marks OR)**
- **Q.** Explain Multigas detector with neat sketch. [Diagram required – refer to the original question paper] **(SUMMER 2022, 7 Marks; SUMMER 2024, 7 Marks; SUMMER 2025, 7 Marks)**

4. Methane Drainage:

- **Q.** What do you mean by methane drainage? With a neat sketch, explain “superjacent heading method” / “Cross-measures method” / any one method of methane drainage. [Diagram required – refer to the original question paper] **(WINTER 2022, 7 Marks OR; WINTER 2023, 7 Marks OR; WINTER 2024, 7 Marks; SUMMER 2026, 4 Marks)**

Other Important Questions:

1. Composition, Permissible Limits and Types of Gases:

- **Q.** Write the composition of dry air. **(WINTER 2024, 3 Marks)**
- **Q.** Write the permissible concentration of various gases as per mine regulation. **(WINTER 2022, 3 Marks)**
- **Q.** Explain after damp. **(SUMMER 2023, 3 Marks OR)**
- **Q.** What is the physiological effect of the following gases on human beings? (a) H_2S (b) SO_2 (c) CO_2 **(WINTER 2024, 7 Marks OR)**
- **Q.** Write short notes on: 1. White damp 2. NPV and motive column **(SUMMER 2023, 7 Marks - NPV and motive column is listed under Chapter 4)**

2. Gas Detection:

- **Q.** Explain the working of methanometer. **(SUMMER 2023, 4 Marks)**
- **Q.** Describe the methods of detecting carbon dioxide gas in an underground mine. **(WINTER 2023, 4 Marks)**

3. Methane Drainage and Layering:

- **Q.** What are the objectives of methane drainage? **(SUMMER 2023, 7 Marks)**
- **Q.** Define methane layering. **(SUMMER 2023, 3 Marks)**

4. Numerical Problems:

- **Q.** In an underground coal mine a horizontal airway 3 m wide and 2.5 m wide is ventilated with airflow of 900 m^3/min. If rate of methane emission in the airway is 1.5 m^3/min, calculate the methane layering number and state whether the ventilation is adequate to break the layering. **(SUMMER 2023, 7 Marks OR)**
- **Q.** An underground face is ventilated with 70 m^3 of air per minute containing 20.93% O_2, 0.03% CO_2 and 79.04% N_2. A man when doing hard work in a confined space consumes 3.5 m^3 of O_2 and produces 1.3 m^3 of CO_2 per minute. Calculate the percentage composition of return air. Assume the parameters if required. **(WINTER 2023, 4 Marks - marks not clearly legible)**
- **Q.** The analysis of a mine air sample are reported as follows: O_2 = 18.55%, CO_2 = 2.45%, CH_4 = 2.5%, N_2 = 76.5%. Calculate the percentage of mine air and blackdamp as well as the composition of blackdamp. **(WINTER 2023, 7 Marks)**
- **Q.** Calculate the percentage of blackdamp present in a mine which gave the following air analysis results: O_2 = 16.52%, CO_2 = 3.1%, CH_4 = 2.45% and N_2 = 77.93%. **(WINTER 2022)**

Chapter 2: Heat and humidity

Repeated Questions:

1. Effects of Heat and Humidity:

- **Q.** Discuss the effect of heat & humidity at the work places. / Discuss effects of heat and humidity in mines. / List the effect of heat and humidity on human body. **(SUMMER 2022, 3 Marks; SUMMER 2023, 4 Marks; WINTER 2023, 7 Marks; SUMMER 2024, 3 Marks; WINTER 2024, 4 Marks; SUMMER 2025, 3 Marks; SUMMER 2026, 4 Marks)**

2. Humidity and Its Measurement:

- **Q.** Define relative humidity. Explain hygrometer with neat sketch. / What is relative humidity? How relative humidity is measured using whirling hygrometer? / Discuss the construction, application and operation of whirling hygrometer with neat sketch. [Diagram required – refer to the original question paper] **(SUMMER 2022, 4 Marks; WINTER 2023, 7 Marks; SUMMER 2024, 4 Marks; WINTER 2024, 7 Marks; SUMMER 2025, 4 Marks; SUMMER 2026, 7 Marks)**
- **Q.** Define humidity. How it is determined in mines? / Discuss the procedure for determine humidity in mines. **(SUMMER 2022, 3 Marks; SUMMER 2024, 3 Marks; SUMMER 2025, 3 Marks)**

3. Cooling Power and Kata Thermometer:

- **Q.** Explain Kata thermometer with neat sketch. / Write a note on Kata Thermometer. / How cooling power of mine air is measured using Kata thermometer? [Diagram required – refer to the original question paper] **(SUMMER 2022, 3 Marks OR; WINTER 2022, 7 Marks; SUMMER 2023, 7 Marks; WINTER 2023, 4 Marks; SUMMER 2024, 3 Marks; WINTER 2024, 4 Marks; SUMMER 2025, 3 Marks; SUMMER 2026, 4 Marks)**

Other Important Questions:

1. Heat Sources and Cooling of Mines:

- **Q.** List the sources of heat in mine. **(SUMMER 2023, 4 Marks)**
- **Q.** Briefly describe the different methods employed for improving the cooling power of mine. **(SUMMER 2023, 3 Marks)**

2. Psychrometry:

- **Q.** Explain Psychrometry in detail. **(SUMMER 2023, 4 Marks)**

Chapter 3: Air flow through mine openings

Repeated Questions:

1. Standards of Ventilation:

- **Q.** What do you understand by standard of ventilation? / Elaborate Standard of Ventilation. / Discuss the permissible standards of ventilation. / What is the necessity and standard of ventilation? **(SUMMER 2022, 3 Marks OR; SUMMER 2023, 4 Marks; WINTER 2023, 3 Marks; SUMMER 2024, 3 Marks; WINTER 2024, 4 Marks; SUMMER 2025, 3 Marks; SUMMER 2026, 4 Marks)**
- **Q.** Write the recommendations of air velocity required at various places of underground mine as per CMR 1957? / Discuss the permissible air velocities in different types of workings. **(SUMMER 2022, 3 Marks; WINTER 2023, 3 Marks; SUMMER 2024, 3 Marks; WINTER 2024, 3 Marks; SUMMER 2025, 3 Marks; SUMMER 2026, 3 Marks OR)**

2. Resistance and Flow of Air:

- **Q.** What do you mean by equivalent orifice? Explain with neat sketch. / How size of equivalent orifice is determined? [Diagram required – refer to the original question paper] **(WINTER 2022, 4 Marks; SUMMER 2023, 3 Marks; WINTER 2024, 4 Marks; SUMMER 2026, 4 Marks OR)**
- **Q.** Differentiate between frictional resistance and shock resistance. / Write a brief note on Frictional resistance and Shock resistance. **(WINTER 2023, 7 Marks; WINTER 2024, 3 Marks; SUMMER 2026, 3 Marks)**
- **Q.** Differentiate between the term laminar & turbulent flow with neat sketch. [Diagram required – refer to the original question paper] **(WINTER 2023, 3 Marks OR; SUMMER 2026, 3 Marks)**
- **Q.** Explain the resistance of airways in series and parallel. / Discuss the resistance of airways in series and parallel. **(WINTER 2023, 3 Marks; SUMMER 2026, 3 Marks OR)**
- **Q.** What do you understand by Reynolds number? / How Reynolds number is significant for the flow pattern? **(WINTER 2022, 3 Marks; WINTER 2024, 3 Marks)**

3. Economic Design and Flow Control:

- **Q.** Explain the factors affecting the economic design of mine airway. **(WINTER 2022, 3 Marks OR; WINTER 2023, 3 Marks OR; WINTER 2024, 3 Marks; SUMMER 2026, 3 Marks)**
- **Q.** What are the various ventilation structures or flow control devices used in underground mines for regulation and direction of air current? Explain any one in detail. / Name the flow control devices used in mine ventilation. Discuss any two. **(WINTER 2022, 7 Marks; WINTER 2024, 7 Marks)**

Other Important Questions:

1. Theory and Measurement of Air Flow:

- **Q.** Briefly explain the measurement of air quantity with suitable example by Precise traversing method using vane anemometer with neat sketch. [Diagram required – refer to the original question paper] **(WINTER 2022, 7 Marks)**
- **Q.** Write a note on Equivalent Resistance of mines. **(WINTER 2024, 3 Marks)**
- **Q.** How pressure loss is determined by Atkinson's Equation? Explain with one example. **(WINTER 2024, 4 Marks)**

2. Numerical Problems:

- **Q.** Calculate the equivalent resistance of the given circuit of airway if the value of resistances is as follows: R1 = 9 units, R2 = 6 units, R3 = 3 units and R4 = 3 units. [Diagram required – refer to the original question paper] **(SUMMER 2023, 3 Marks)**
- **Q.** Calculate the pressure as well as power required to circulate 20 m^3 of air per second, through a mine airway 300 m long, 2.5 m high and 3 m wide? The coefficient of friction of the airway is 0.01

Ns^2m^{-4}. Also calculate the frictional resistance coefficient (f) for the airway taking the air density at 1.2 kg/m³. Assume the parameters if required. **(SUMMER 2026, 7 Marks)**

- **Q.** Determine the nature of air flow in a mine airway of 2.2 × 1.8 m size if the velocity of air in the airway is 0.5 m/s. Also calculate the maximum velocity at which the flow still remains truly laminar. Assume $u = 0.16 \times 10^{-4}$ m²/s. **(SUMMER 2026, 4 Marks - marks inferred from paper layout)**
- **Q.** A smooth steel duct 0.65 × 0.45 m in size circulates 0.6 m³ of air quantity per second. Calculate the resistance coefficient of the duct and the friction pressure loss in a 130 m length of duct. Assume density of the air is 1.2 kg/m³ and $v = 0.16 \times 10^{-4}$ m²/s. **(WINTER 2022, 7 Marks)**
- **Q.** The average air velocity as measured in a 2 m diameter smooth-lined airway is 0.02 m/s. What is the maximum velocity of flow and where does it occur in the airway? If the average velocity is raised to 0.5 m/s, what would be the maximum velocity of air? Take $u = 0.16 \times 10^{-4}$ m²/s. **(WINTER 2022, 7 Marks)**
- **Q.** Calculate the pressure required to circulate 2400 m³ per minute of air through a 2500 m long tunnel of 3.5 × 3.0 m cross-section with k = 0.0098 Ns^2m^{-4}. **(WINTER 2023, 3 Marks - page 2, marks as printed/legible)**

Chapter 4: Natural ventilation

Repeated Questions:

1. Natural Ventilation: Causes and Working:

- **Q.** Discuss the causes of natural ventilation. / How natural ventilation is occurred? Explain with neat sketch. / Define natural ventilation. [Diagram required – refer to the original question paper] **(SUMMER 2022, 3 Marks; WINTER 2022, 3 Marks; SUMMER 2023, 3 Marks; SUMMER 2024, 3 Marks; SUMMER 2025, 3 Marks)**
- **Q.** Explain working of natural ventilation with neat sketch. [Diagram required – refer to the original question paper] **(SUMMER 2022, 7 Marks; SUMMER 2024, 7 Marks; SUMMER 2025, 7 Marks)**
- **Q.** Discuss the effect of seasonal variations in natural ventilation. **(SUMMER 2022, 3 Marks OR; SUMMER 2024, 3 Marks OR; SUMMER 2025, 3 Marks)**
- **Q.** Differentiate between Homotropical and Antitropical ventilation. **(SUMMER 2022, 4 Marks OR; SUMMER 2024, 4 Marks OR; SUMMER 2025, 4 Marks)**

2. Natural Ventilation Pressure and Thermodynamics:

- **Q.** How is natural ventilating pressure produced? Derive the equation of natural ventilation pressure from air density. **(WINTER 2023, 7 Marks OR; WINTER 2024, 7 Marks; SUMMER 2026, 7 Marks OR)**
- **Q.** Explain thermodynamics of ventilation in brief. / Explain thermodynamics of ventilation. **(SUMMER 2022, 7 Marks; SUMMER 2024, 7 Marks; SUMMER 2025, 7 Marks)**

3. Numerical Problems:

- **Q.** Air temperature in downcast and upcast shafts 440 m deep is 28°C and 34°C respectively. Calculate the height of motive column. Also find out the density of downcast air and the amount of natural ventilation pressure (N.V.P). Assuming the average barometric pressure in downcast shaft to be 750 mm of Hg. / Air temperature in downcast and upcast shafts 465 m deep is 29°C and 36°C respectively. Calculate the height of motive column. Also find out the density of downcast air and the amount of natural ventilation pressure (N.V.P). Assuming the average barometric pressure in downcast shaft to be 750 mm of Hg. **(WINTER 2022, 7 Marks; WINTER 2023, 7 Marks)**

Other Important Questions:

1. Natural Ventilation: Factors, NVP and Motive Column:

- **Q.** List the factors affecting natural ventilation in an underground mine. **(SUMMER 2023, 4 Marks)**
- **Q.** Write short notes on: 1. White damp 2. NPV and motive column. **(SUMMER 2023, 7 Marks - White damp is listed under Chapter 1)**
- **Q.** Explain the method of determination of NPV in underground mine from thermodynamics consideration. **(SUMMER 2023, 7 Marks)**

Chapter 5: Mechanical ventilation

Repeated Questions:

1. Fan Characteristics and Types of Fans:

- **Q.** Describe the characteristics and suitability of fans. **(SUMMER 2022, 4 Marks; SUMMER 2024, 4 Marks; SUMMER 2025, 4 Marks)**
- **Q.** Explain the construction and working of centrifugal fan. Also write the equation of theoretical head developed by centrifugal fan. / Explain centrifugal fan in detail. **(WINTER 2023, 4 Marks; WINTER 2024, 7 Marks; SUMMER 2026, 7 Marks)**
- **Q.** Write a brief note on axial flow fan with neat sketch. [Diagram required – refer to the original question paper] **(WINTER 2023 - page 2; WINTER 2024, 7 Marks)**

2. Operation and Configuration of Fans:

- **Q.** Explain effect of connection of different type of fan in series and parallel in underground mine. / Describe parallel and series operation of mines fans. / What is meant by characteristics curve? Explain characteristics curve of mine fans in series and parallel with neat sketch. [Diagram required – refer to the original question paper] **(SUMMER 2022, 4 Marks; WINTER 2022, 7 Marks; SUMMER 2023, 7 Marks; SUMMER 2024, 4 Marks; SUMMER 2025, 4 Marks)**
- **Q.** Describe the forcing and exhaust configurations of fan. **(SUMMER 2022, 4 Marks; SUMMER 2024, 4 Marks OR; SUMMER 2025, 4 Marks)**

3. Booster and Auxiliary Ventilation:

- **Q.** Explain the construction and working of Booster fan and Auxiliary fan with neat sketch. [Diagram required – refer to the original question paper] **(SUMMER 2022, 7 Marks; SUMMER 2024, 7 Marks; SUMMER 2025, 7 Marks)**
- **Q.** Discuss auxiliary ventilation system with neat sketch. / What do you understand by auxiliary ventilation? Explain with neat sketch. [Diagram required – refer to the original question paper] **(WINTER 2023, 3 Marks; WINTER 2024, 4 Marks; SUMMER 2026, 4 Marks)**

Other Important Questions:

1. Theory of Mine Fans:

- **Q.** What are different types of mine fans? Explain in detail. **(SUMMER 2023, 7 Marks)**
- **Q.** Differentiate between evasé and diffuser. **(SUMMER 2023, 4 Marks)**
- **Q.** What do you mean by Reversal of Flow with respect to mechanical ventilation in underground mines? **(SUMMER 2023, 7 Marks)**
- **Q.** Discuss “fan laws” in detail. **(WINTER 2022, 3 Marks)**
- **Q.** How performance of axial flow fan varies with changing pitch? **(WINTER 2022, 3 Marks)**
- **Q.** Compare the centrifugal fan with an axial flow fan. **(WINTER 2022, 4 Marks)**
- **Q.** Explain the conditions in which booster fan is installed. **(WINTER 2022, 3 Marks)**

2. Numerical Problems:

- **Q.** Calculate the pressure developed by a backward bladed centrifugal fan having the following specifications: Fan Diameter – 3.4 m, RPM – 350, Blade angle – 40 degree, Velocity of flow – 4.8 m/s, Air density – 1.2 kg/m^3, width at periphery – 1.5 m. **(WINTER 2022)**

Chapter 6: Ventilation planning

Repeated Questions:

1. Ventilation Planning and Layouts:

- **Q.** Explain the planning of the ventilation system in an underground coal mine. / Explain the planning of ventilation systems and economic considerations. / Write the steps involved in ventilation planning. **(SUMMER 2022, 7 Marks; SUMMER 2023, 7 Marks; SUMMER 2024, 7 Marks; WINTER 2024, 3 Marks; SUMMER 2025, 7 Marks)**
- **Q.** Explain ventilation layouts for mining of coal and ore deposits. **(SUMMER 2022, 4 Marks; SUMMER 2024, 4 Marks; SUMMER 2025, 4 Marks)**
- **Q.** What are the desirable features of good ventilation system? / Write the Desirable features of ventilation system. **(WINTER 2022, 3 Marks; SUMMER 2026, 3 Marks OR)**

2. Ventilation Survey:

- **Q.** Define ventilation survey. / Write a short note on ventilation survey in underground mine. / Name the instruments used for ventilation survey. Explain any one in detail. **(SUMMER 2023, 3 Marks; WINTER 2023, 4 Marks; WINTER 2024, 7 Marks)**

Other Important Questions:

1. Ventilation Systems:

- **Q.** Explain the ventilation system or air distribution in Shrinkage stopping method with neat sketch. [Diagram required – refer to the original question paper] **(WINTER 2022, 4 Marks)**
- **Q.** What do you understand by boundary ventilation system? Explain with neat sketch. [Diagram required – refer to the original question paper] **(WINTER 2022, 7 Marks)**
- **Q.** Describe the types of ventilation system based on air direction with neat sketch. [Diagram required – refer to the original question paper] **(SUMMER 2026, 7 Marks)**

2. Numerical Problems:

- **Q.** What is the minimum quantity of air required to ventilate an underground coal mine district producing 250 tonnes of coal per shift employing a maximum of 150 persons in a shift? **(WINTER 2022)**

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