Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – I • EXAMINATION – WINTER • 2014

Subject code: 2711801 **Date: 06-01-2015**

Subject Name: Application Based Systems for Air Pollution Control Management

Time: 02:30 pm - 05:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Explain Following Terms **07**

1. PM 2.5 2. PM 10 3. Smoke 4. Smog 5. Albedo 6. Calm condition 7. Radiosonde

(b) Wind Rose Diagram with neat sketch **07**

Q.2 **(a)** Describe the characteristics of stack plumes with temperature profile and plume shape in the x-z coordinates system for various atmospheric conditions. **07**

(b) Sulfur dioxide is being emitted at a rate of 0.90 kg/s from a stack with an effective height of 150 m. The average wind speed at stack height is 4.8 m/s and the stability category is B. Determine the short-time period, downwind, center-line concentration in micrograms per cubic meter at ground-level distances from the stack of (a) 600 m (b) 1000 m (c) 1200 m (d) 1600 m (f) 2000 m (g) 3000 m and (h) 4000 m **07**

OR

(b) Estimate the total hydrocarbon concentration at a point 200 m downwind from an expressway at 6.10 pm on an overcast day. The wind is perpendicular to the highway and has a speed of 4.0 m/s. The traffic density along the highway is 8000 vehicles per hour, and the average vehicle speed is 50 km/hour. The average vehicle emission rate of hydrocarbon is 2.3×10^{-2} g/s. **07**

Q.3 **(a)** Explain following air pollution control equipments with neat sketches. **07**

1. Bag Filter with pulse jet cleaning systems.
2. Cyclone Separator

(b) The wind and stack gas speeds are 4 m/s and 5.8 m/s, respectively, and the stack diameter is 1800 mm. The atmospheric stability condition is neutral with a temperature of 300 ^{o}K, and the stack gas temperature is 440 ^{o}K. Estimate the plume rise in meters by the Briggs equation. **07**

OR

Q.3 **(a)** Explain following air pollution control equipments with neat sketches. **07**

1. Electro-static Precipitators
2. Multi-cyclone separator

(b) Sulfur dioxide is emitted at a rate of 170 g/s in to an atmosphere where the wind speed is expected to be approximately 5.5 m/s at stack height. It is desired that the ground-level concentration at the center line not exceed 200 µg/m^3 at a distance of 800 m. What effective stack height is required in, meters ? **07**

Q.4 **(a)** Write the design steps for Absorption Tower. **07**

(b) A cloth fitter has R_f & R_p resistance values of 37,000 kg/m^2s and 61,000 s^{-1}, respectively. The filter area is 2200 m^2 and the volume flow rate of air is 11 m^3/s with a dust loading Ld of 12 g/m^3. Determine, **07**

a. The pressure drop at startup in N/m^2 and millibars,
b. The mass area concentration W after 3 hr of operation in kg/m^2 and
c. The pressure drop after 2 hours in N/m^2 and milibars.

OR

Q.4 **(a)** Write down the sources of sulfur dioxide and explain its control methods with neat sketches. **07**

(b) If the process gas exhaust rate is 5 x 10^6 cm^3/s, determine the number of bags required in the pulse jet type bag house along with their arrangements. **07**

Q.5 **(a)** Write notes on following particulates control equipments **07**

1. Spray tower.
2. Venturi scrubber

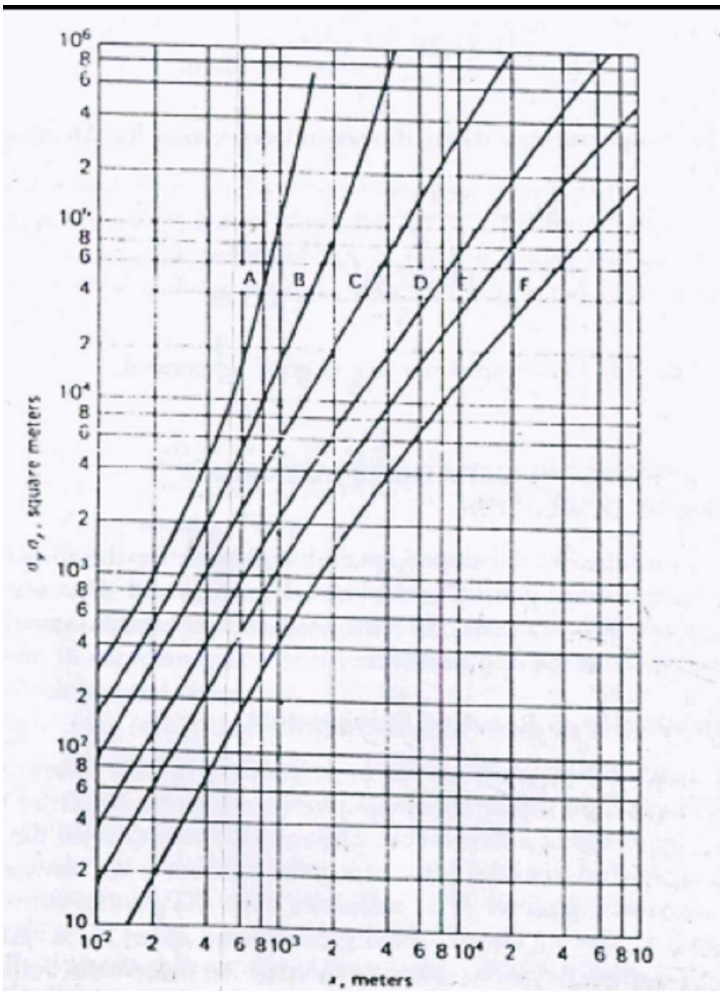
(b) Control methods of Nitrogen oxides. **07**

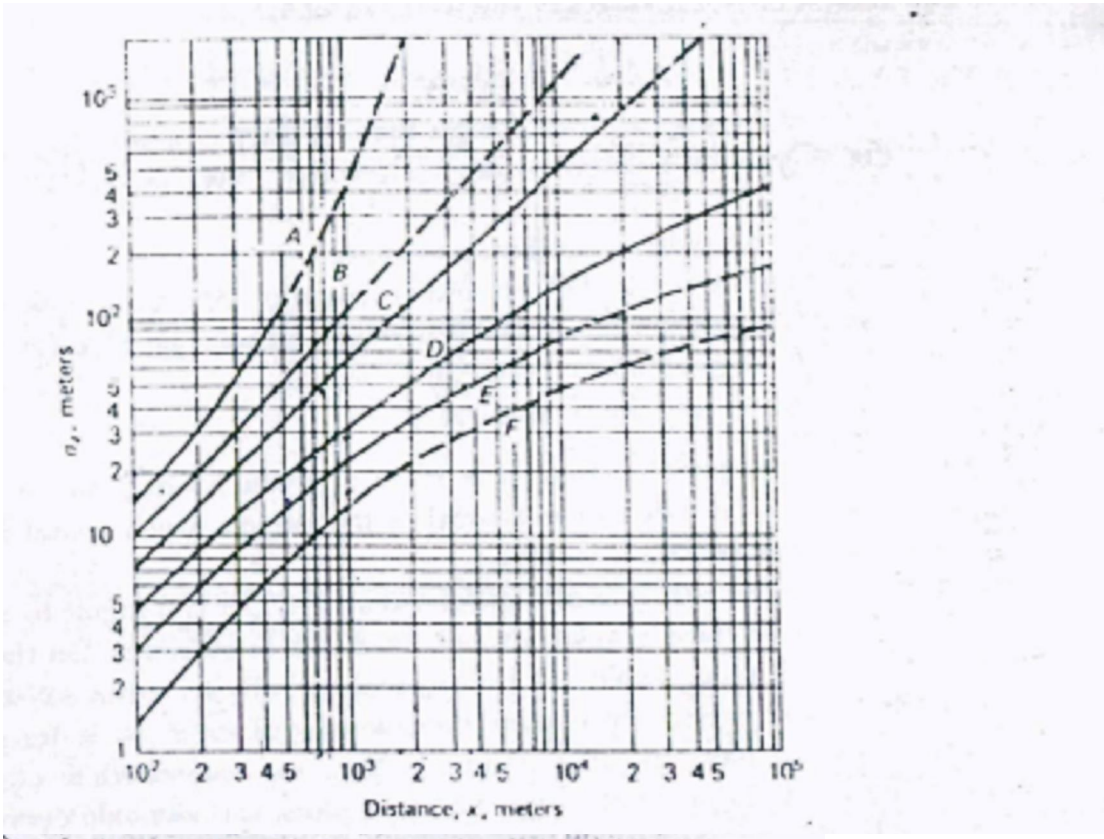
OR

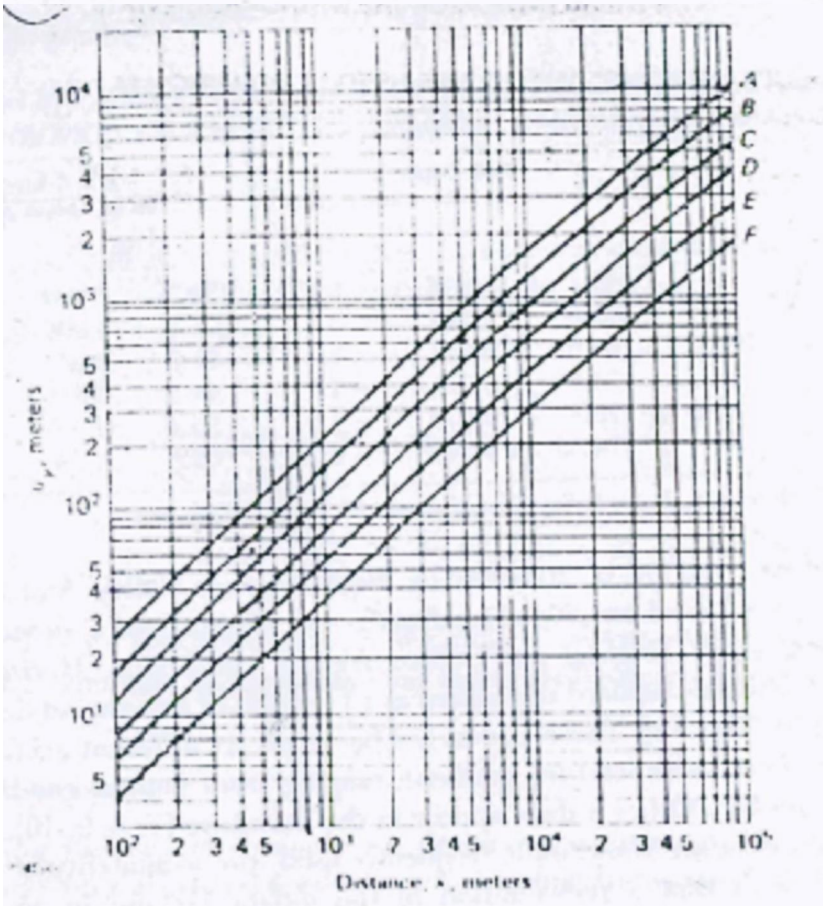
Q.5 **(a)** Write notes on **07**

1. Air to cloth ratio for fabric filters
2. Particle size distribution

(b) An electrostatic precipitator with a specific collection area of 0.984 m^2 /m^3/min is found to have an actual overall collection efficiency of 97% if the value of A/Q is increased to 1.321 m^2/m^3/min. Estimate two inticipated collection efficiency on the basis of (i) Deutsch equation (ii)Hazen-type equation with value of n is equal to 4. **07**


A
B
C
D
E
F
square meters
meters


A
B
C
D
E
F
σ_y, meters
Distance, x, meters


A
B
C
D
E
F
σ_z, meters
Distance, x, meters