

GUJARAT TECHNOLOGICAL UNIVERSITY
M. E. - SEMESTER – I • EXAMINATION – WINTER • 2013

Subject code: **711801**

Date: 23-12-2013

Subject Name: Air Pollution Control and Management**Time:** 10.30 am – 01.00 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) Draw a neat sketch of cyclone separator and explain its construction and working. **07**

- (b)** Write notes on **07**
1. Windrose diagram
 2. Maximum mixing depth
 3. Inversion

Q.2 (a) The wind and stack gas speeds are 6 m/s and 10 m/s, respectively, and the stack diameter is 1000 mm. The atmospheric stability condition is neutral with a temperature of 30 °C, and the stack gas temperature is 150 °C. Estimate the plume rise in meters by the Briggs equation. **07**

- (b)** Particulate matters are emitted at a rate of 200 g/s into an atmosphere where the wind speed is expected to be approximately 5 m/s at stack height. It is desired that the ground-level concentration at the center line not exceed 200 µg/m³ at a distance of 600 m. What effective stack height required, in meters ? **07**

OR

- (b)** Estimate the total hydrocarbon concentration at a point 300 m downwind from an expressway at 5.30 pm on an overcast day. The wind is perpendicular to the highway and has a speed of 4 m/s. The traffic density along the highway is 7000 vehicles per hour, and the average vehicle speed is 50 km/hour. The average vehicle emission rate of hydrocarbons is 2×10^{-2} g/s. **07**

Q.3 (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 0.8 kg/s from a stack with an effective height of 200 m. The average wind speed at the stack height is 5 m/s and the stability category is B. Determine the short time period, downwind, centerline concentration in µg/m³ at ground level distances from the stack of 1.5 km and 3 km. **07**

OR

- Q.3 (a)** Write notes on **07**
1. Adsorption Isotherm
 2. Design requirement for adsorption equipment
 3. Flood point for packed adsorption tower

- (b)** Sulfur dioxide is being emitted at a rate of 200 g/s from a stack with an effective height of 50 m. The average wind speed at the stack height is 6 m/s and the stability class is D for the overcast day. Determine the concentration crosswind at 40 m from the center line for the downwind distance of 400 m. **07**

Q.4 (a) You are located downwind from two oil burning power plants. One is located 0.3 **07**

km NNE of your location and burns 1400 kg of 0.6 % sulfur oil per hour. The second plant is located 0.5 km NNW of you and burns 1600 kg/h of fuel oil containing 0.8 % sulfur. Assume that both plant stacks have an effective height of 40 m. The wind is blowing from the North direction at 3.3 m/s. For a class B stability condition, what is the SO_2 concentration at your location at ground level, in $\mu\text{g}/\text{m}^3$?

- (b) Gas with the composition essentially of air exits from a stack with velocity of 9 m/s. The gas temperature is 190°C , and the atmosphere temperature at the top of the stack is 20°C . The stack diameter is 1.2 m and the wind speed at the top of the stack is 4.5 m/s. Determine the plume rise using Holland equation. 07

OR

- Q.4 (a) Explain the construction and working of venture scrubber along with a neat sketch. 07

- Q.4 (b) Write a note on “ Bag filter with pulse jet cleaning mechanisms.”. 07

- Q.5 (a) Explain flue gas desulfurization processes in detail. 07

- (b) Note down the advantages and disadvantages of electrostatic precipitators (ESP). 07

OR

- Q.5 (a) Explain particulate collection mechanisms. 07

- (b) Explain the factors that control the formation of NO_x in combustion processes. 07



