GUJARAT TECHNOLOGICAL UNIVERSITY ME – SEMESTER-1 (NEW) EXAMINATION – WINTER 2016

Subject Code: 2711801Date:03/01/2017Subject Name: Application based systems for air pollution control managementTime: 2:30 pm to 5:00 pmTotal 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:
 08

 1. Windrose Diagram
 2. Effects of CO on health 3. Effects of Ethylene on plant 4. Maximum mixing depth
 08
 - (b) Write down effects of atmospheric Particulate matter on human health. 06
- Q.2 (a) An existing power plant has been found to produce an SO₂ concentration 07 of 20 μ g/m³ at a distance of 800 m directly downwind from the stack when the wind velocity is 4 m/s from the north during a class C stability situation. At a later date another plant is built 200 m to the west of the original plant. It burns 2000 kg/h of fuel oil which contains 0.5 % sulfur. The second plant has an effective stack height of 60 m, and it has no SO₂ emission controls. For the same atmospheric conditions listed above, estimate the percentage of increase in SO₂ concentration at the downwind site due to the second plant.
 - (b) Derive expressions for X_{max} and C_{max} for the situation where $\sigma_y = ax^p$ and $\sigma_z = bx^q$

OR

- (b) Describe the characteristics of stack plumes with temperature profile and plume shape in the x-z coordinates system for various atmospheric conditions.
- Q.3 (a) 1. Explain maintenance issues for Bag filter having pulse jet cleaning 07 systems.

2. Write a note on Multi cyclone separator with neat sketch.

(b) The traffic density for an interstate highway is 10000 vehicles/hour and the 07 average vehicle speed is 80 km/hour. The wind speed perpendicular to the highway is 3 m/s. The average carbon monoxide emission per vehicle is 20 g/km. For an overcast day, estimate the CO concentration 1 km downwind from the highway.

OR

- Q.3 (a) Explain following air pollution control equipments with neat sketches.
 - 1. Electro-static Precipitators
 - 2. Packed bed scrubber

07

(b) The following data apply to a coal burning steam power plant : stack 07 height : 200 m, stack diameter ; 9 m, coal firing rate : 1.165 x 10⁶ kg/day; air supply rate 12 kg air /kg coal; stack gas temperature 150 °C; ambient air temperature at 350 m, 7 °C; heating value of coal 5250 KJ/kg; sulfur content of coal 3.1 %; ash content of coal 8 %; ash carried up the stack; 80 %, atmospheric conditions cloudy, daytime, wind speed 6 m/s at 10 height; temperature gradient, neutral. Calculate the effective stack height using (a) Carson & Moses equation (b) The Holland formula (c) the original Concawe formula.

Q.4 (a) Explain the principle of control for NOx using following:

07

- (i) Low NOx Burners
- (ii) Flue Gas Recirculation
- (iii) Air Staging and Fuel Staging
- (iv)Reduced Air Preheat
- (v) Fuel reburning
- (vi)Ultra Low NOx Fuels
- (vii) Over fire Air
- (b) Enlist and explain major strategies for the reduction of SO₂ emissions 07 from the thermal power plant?

OR

- Q.4 (a) Enlist the different components of NOx with its valence & properties. 07
 - (b) Explain the Carbon adsorption process with neat sketch for the removal of **07** SOx.
- Q.5 (a) Explain the stack monitoring procedure for particulate matter with neat 07 sketch of sampling train.
 - (b) What are the annual average concentration of the following pollutants in 07 the ambient air (Residential Area) and also give the name of methods of measurement.

(i) SO₂ (ii) PM₁₀ (iii) Lead (iv) Ammonia (v) NO₂ (vi) PM_{2.5} (vii) Arsenic

OR

- Q.5 (a) Write down the procedure for monitoring & analysis of $PM_{2.5}$ in ambient 07 air using gravimetric method.
 - (b) How to control the air pollution from the automobile sources?. 07

