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Your Roll No.

B.Tech. (C) / IV

J

Paper ECE-408

ENVIRONMENTAL POLLUTION CONTROL

Time : 3 hours

Maximum Marks : 70

*(Write your Roll No. on the top immediately
on receipt of this question paper.)*

*Attempt any five questions. Assume suitable missing
data. Draw neat labelled diagrams wherever needed.*

1. (a) Differentiate between Dry and Wet Adiabatic Lapse Rate. Using illustrations discuss the effect of adiabatic lapse rate on atmospheric stability. 7
- (b) With the help of neat sketches, explain the plume phenomenon.
 - (i) Looping
 - (ii) Trapping
 - (iii) Coning
 - (iv) Lofting
 - (v) Fumigating.

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2. (a) A power plant burns 5.45 tonnes of coal per hour and discharges the products of combustion

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through a stack that has an effective height of 75 m. The coal has sulphur content of 4.2%, and the wind velocity at the top of the stack is 6.0 m/sec. Find the maximum ground level concentration of SO_2 . Assume $\sigma_y = 88$ m at the point of maximum concentration. 7

(b) Name and describe *three* control devices developed for the control of automotive emissions. 7

3. (a) Discuss combustion process for air pollution control. What are the *four* key factors affecting efficiency of combustion as air pollution control? Discuss various systems of combustion processes. 7

(b) Discuss absorption process for the control of gaseous contaminants in air. Explain various configurations of sorption units by which gaseous contaminants can be removed from air. 7

4. (a) Draw a neat sketch of a typical cyclone, and show the relative dimensions of various segments on it. 7

(b) Determine the size of settling chamber for volumetric flow rate of $1,000 \text{ m}^3/\text{hr}$, and particle density 3000 kg/m^3 , the viscosity of air at temperature 20°C is taken to be $18.2 \times 10^{-6} \text{ N.S/m}^2$. Also determine (i) the diameter of the

particle which will be removed completely, (ii) height of the chamber for 100% collection of $40\text{ }\mu\text{m}$ particles when length remains same. 7

5. (a) Discuss silicon treatment, antistatic treatment, and calendaring with regard to fabric filter used for air pollution control. 7

(b) A filter baghouse must treat $15\text{ m}^3/\text{sec}$ of waste gas. The baghouse is divided into eight sections of equal cloth area so that one section can be shut down for cleaning and/or repairs while others continue operating. Laboratory analysis indicates an air to cloth ratio of $9.0\text{ m}^3/\text{m}^2\cdot\text{mi.}$ cloth will provide sufficient treatment. The bags are 0.25 m in diameter and 7.0 m long. Determine the number of bags and the physical arrangement to meet the above requirement. 7

6. (a) Discuss the construction and functioning of Electrostatic Precipitator. What are the advantages and disadvantages of Electrostatic Precipitators? 7

(b) Stack gas flows through an electrostatic precipitator at a rate of $12\text{ m}^3/\text{sec}$, the plate area is 250 m^2 and the drift velocity for the system has been found to be $2.8 \times 10^{-5} d_p$. Draw a size efficiency curve for particles ranging in size from 0.1 to $10\text{ }\mu\text{m}$. 7

7. Determine the fractional efficiency and total efficiency of a gravity settling chamber for $Q=10000 \text{ m}^3/\text{hr}$, particle density $=3200 \text{ kg/m}^3$, temperature 20°C . The percentage distribution of $5 \mu\text{m}$, $10 \mu\text{m}$, $20 \mu\text{m}$, $30 \mu\text{m}$, $50 \mu\text{m}$, $75 \mu\text{m}$, $100 \mu\text{m}$, and $120 \mu\text{m}$ is 8%, 2%, 4%, 8%, 10%, 18%, 38%, and 12%. Also draw size efficiency curve.

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