

AIR POLLUTION AND ITS CONTROL

Time: Three Hours

Maximum Marks: 100

Answer five questions, taking ANY TWO from Group A, any two from Group B and all from Group C.

All parts of a question (a, b, etc.) should be answered at one place.

Answer should be brief and to-the-point and be supplemented with neat sketches.

Unnecessary long answer may result in loss of marks.

Any missing or wrong data may be assumed suitably giving proper justification.

Figures on the right-hand side margin indicate full marks.

Group A

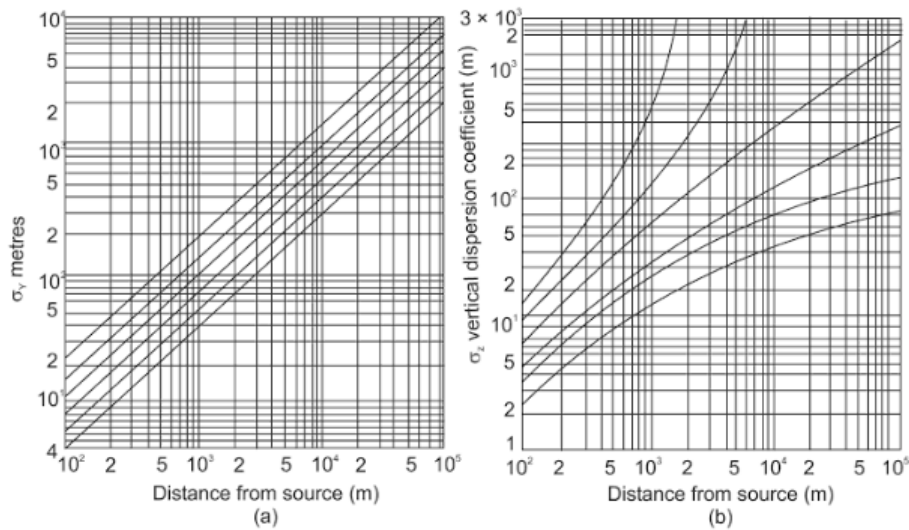
1. (a) Name the pollutants/contaminants considered in defining the ambient air quality standard, say, in an urban area. Also, write the effects of pollutants on man and vegetation. Suggest methods to control these. 8
- (b) What is meant by scales of pollution? Name and explain in brief. Name the so called six criteria of pollutants along with their sources that pollute the air. 6
- (c) What is understood by air quality standard? What are the air quality standards in India? Discuss briefly. 6
2. (a) Write a note on green house gases. 6
- (b) Write short note on atmosphere of sun. How does sun atmosphere contribute towards air pollution studies. 6
- (c) Identity the common pollutants found in exhaust gases emitted by the automobiles commonly operate in towns and cities in India. Briefly describe at least one of the measures that would contain ambient air pollution from auto exhaust. 8
3. (a) How SO_x , CO and NO_x affect human health? Discuss. 10
- (b) Describe in detail about the adverse effects of air pollution on human health, 10

vegetation and property.

4. (a) You have to conduct a general air pollution survey of an Indian class. A city. List the factors that are to be considered. Give the flow chart for planning and execution of survey. Name the instruments needed for the programme. 10
- (b) List various methods of sampling and describe any two in detail. 10

Group B

5. (a) The adiabatic lapse rate (temperature variation with altitude) in a dry steady state atmosphere can be expressed by 10
- $$-(dT/dZ) = g(k - 1)/kR$$
- in which the notation have their conventional meanings. Obtain the expression.
- (b) What is temperature inversion and describe the significance of temperature inversion. 10
6. (a) A stack (effective height 20 m) is discharging flue at the rate of 0.1 kg/s. The average wind speed on a clear day around is 4 m/s. Estimate the ground level concentration of the particulate matters ($\mu\text{g}/\text{m}^3$) at a distance of 200 m from the stack. Assume that the distribution of particulates roughly follow Gaussian distribution and $\sigma_z = 22$ m and $\sigma_y = 30$ m. 10
- (b) Explain the Gaussian plume model with equation. List the assumptions made in Gaussian plume model. 10
7. (a) Sulphur dioxide is emitted at a rate of 150 g/s from stack with an effective height of 60 m. The wind speed at height is 6 m/s and the atmospheric stability class is C. Estimate the distance at which reflection from the stable layer just begins to occur, in metres, for the inversion layer 150 m above ground level. Also, find the concentration at a distance of $2x_L$. You may refer following figures in solving the problems. 12



- (b) Write short note on electrostatic precipitator. 8
8. (a) Describe method of air cleaning process by cyclone separator. Discuss the advantages and disadvantages of cyclone separators in brief. 10
- (b) Calculate the diameter of smallest particle which can theoretically be completely 50% separated from a gas stream in cyclone having 20 turns and inlet width of 1 cm through which a fluid of 20 viscosity is moving at a velocity of 0.85 cm/s (considering 1 as density of particle and fluid to be 0.5). 10

Group C

9. Answer the following in brief: 20
- (i) A copy machine is to be installed in a small room. There is concern that the ozone level in the room may be too high unless room is properly ventilated. The volume of the room is 19.8 m^3 and the recommended air changes in the room is 30 times in an hour. Determine the capacity of the fan.
 - (ii) Name any two diseases on vegetation due to air pollution.
 - (iii) What is ozone hole?
 - (iv) What is clean fuel?
 - (v) Explain radiation inversion.
 - (vi) What is the standard method used for measuring carbon monoxide levels

in the ambient air?

- (vii) Calculate the minimum size of the particle that will be removed with 100% efficiency from a settling chamber under the following conditions: Horizontal velocity = 0.3 m/sec, specific gravity = 2, length of chamber = 7.5 m, height of chamber = 1.5 m, viscosity of air = 2.1×10^{-5} kg/m-sec. correction factor = 2.
- (viii) The concentration of NO_2 in an enclosed chamber is set at 460 mg/m^3 at a pressure of 760 mm of mercury and at a temperature of 25°C . Determine the concentration level in ppm.
- (ix) A PM_{10} sampler operated for 8 hr at an average flow rate of 16.5 litre/min. The initial and final weight of the filter paper was 0.15 g and 0.1605 g, respectively. Calculate the PM_{10} concentration.
- (x) Define trapping plume.

(Refer our course material for answers)