

ENVIRONMENTAL MANAGEMENT

(CE 805/10)

Time : 2 hours

Full Marks : 35

Answer question no. 1 and any three from the rest

1. Answer any two questions:

(a). State five steps for the implementation of Ecosystem Approach. Explain any two of the five steps for the implementation of Ecosystem Approach. (4)

(b) State the 12 principles of Ecosystem Approach. Explain any two of the 12 principles of Ecosystem Approach. (4)

(c) For the metropolitan city of Kolkata, a traditional wastewater practice was considered as a formal wastewater treatment technology under the Ganga Action Plan. Describe the wastewater ecosystem (with a sketch) briefly. What are the traditional indicators to understand the quality of wastewater in East Kolkata Wetland ecosystem. How are the embankments in the East Kolkata Wetland protected from erosion due to waves (a sketch with a description only)? (4)

2. A city discharges 115000 m³/d of wastewater into a stream into a stream whose minimum rate of flow is 8.5 m³/s. The velocity of the stream is about 3.2 km/h. The temperature of the wastewater is 20°C, and that of the stream is 15°C. The 20°C BOD₅ of the wastewater is 200 mg/L and that of the stream is 1.0 mg/L. The wastewater contains no dissolved oxygen, but the stream is 90% saturated upstream of the discharge. At 20°C, k_1 is estimated to be 0.3 per day and k_2 is 0.7 per day. Determine critical oxygen deficit and its location. Use temperature coefficients of 1.135 for k_1 and 1.024 for k_2 . At 15°C, the dissolved oxygen solubility may be taken as 10 mg/L.

(9)

3. (a) The Government of India launched the eco-labelling scheme known as 'Ecomark' in 1991. What are the objectives of the scheme of ecomark? Which environmental impacts of a product are considered to be the criteria for ecomark? Name another ecolabel from any other country. What is the logo for Ecomark?

(b) Name at least four product categories for which the Government of India has notified the final criteria for the ecomark. Suggest strategies for popularizing the 'ecomark' scheme.

(5+4)

4. (a) Prepare an environmental impact matrix for a hydroelectric project under the following headings : Site Preparation, Reservoir, Dam, Power Transmission.

(b) Prepare an environmental impact matrix for the management of municipal solid wastes under the following headings : Sources; Collection and Transport; Processing; Disposal,

(c) Prepare an environmental impact matrix for 'urbanisation'.

(3+3+3)

5. (a) A bar with a volume 500 m^3 has 50 smokers in it, each smoking two cigarettes per hour. An individual cigarette emits, among other things, about 1.40 mg of formaldehyde (HCHO). Formaldehyde converts to carbon dioxide with a reaction rate coefficient $K = 0.4/\text{hour}$. Fresh air enters the bar at the rate of $1000 \text{ m}^3/\text{hour}$ and stale air leaves at the same rate. Estimate the steady state concentration of formaldehyde in the air, assuming complete mixing. At 20°C and 1 atm of pressure, how does the result compare with threshold for eye irritation of about 0.05 ppm?

(b) Suppose the air in the bar is clean when it opens at 5 P.M. If formaldehyde with reaction rate $K = 0.4/\text{hour}$ is emitted from cigarette smoke at the constant rate (as indicated previously) starting at 5 P.M., what would be the concentration at 6 P.M.?

(c) A lagoon is to be designed to accommodate an input flow of $0.10 \text{ m}^3/\text{s}$ of non-conservative pollutant with concentration 30.0 mg/L and reaction rate $0.20/\text{day}$. The effluent from the lagoon must have pollutant concentration of less than 10.0 mg/L . Assuming complete mixing, how large must the lagoon be?

(3+3+3)

6. (a) Consider a box model for an air shed over a city $1 \times 10^5 \text{ m}$ on a side, with a mixing depth of 1200 m . Winds with no SO_2 blow at 4 m/s against one side of the box. SO_2 is emitted in the box at the rate of 20 kg/s . If SO_2 is considered to be conservative, estimate the steady-state concentration in the air shed.

(b) With the same air shed and ambient conditions, assume the emission occur only on weekdays. If emissions stop at 5 p.m. on Friday, estimate the SO_2 concentration at midnight. If they start up again on Monday at 8 a.m., what would the concentration be by 5 p.m.?

(c) Assume that steady-state conditions have been reached for the city and then the wind speed drops to 2 m/s . Estimate the concentration of SO_2 two hours later.

(d) If the wind blowing into the air shed has $5 \mu\text{g}/\text{m}^3$ of SO_2 in it, and the SO_2 concentration in the air shed at 8 a.m. on Monday is $10 \mu\text{g}/\text{m}^3$, estimate the concentration at noon, assuming that emissions are still 20 kg/s .

(3+2+2+2)

7. (a) Why the DO profile in any river assumes the shape of a sag curve downstream of the point of discharge of a waste? What is the self-purification capacity of a river?

(b) What do you understand by non-point source pollution?

(c) What is BOD of a wastewater sample? The BOD_5 of a wastewater sample is determined to be 150 mg/L at 20°C . The k value is known to be 0.23 per day. What would the BOD_8 be if the test were run at 15°C ?

(4+2+3)