ENVIRONMENTAL ENGINEERING & POLLUTION CONTROL
(CHEN 4243)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) The removal of CO_2 from earth s atmosphere and long term storage of carbon in terrestrial bioshere is known as
(a) carbon dating (b) carbon fixing
(c) carbon sequestration (d) photosynthesis.

(ii) For separation of fine particulate matter from flue gases,the equipment prescribed is
(a) cyclone separator (b) spray chamber
(c) electro static precipitator (d) fabric filter.

(iii) Which of the following is the secondary air pollutant?
(a) NO_x (b) SPM
(c) PAN (d) SO_x.

(iv) In a pulp & paper industry using sulfite process, the untreated effluent is known as
(a) black liquor (b) red liquor
(c) white liquor (d) green liquor.

(v) Trickling Filter is actually
(a) a continuous filter (b) a vacuum filter
(c) a trickle bed reactor (d) a semi-batch filter.

(vi) The value of MLSS would be around _____ for an efficiently operated activated sludge process.
(a) unity (b) 100
(c) infinity (d) 2000.

(vii) The Hydraulic Retention Time of a typical Activated sludge process would be around
(a) one hour (b) 7-15 hours
(c) infinity (d) cannot be predicted.

(viii) The waste stabilization pond needs
(a) aerator (b) primary clarifier
(c) facultative pond (d) secondary clarifier.

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(a) aerator (b) primary clarifier
(c) facultative pond (d) secondary clarifier.

(x) As per the CPCB standard for discharge of liquid waste into inland surface water the values of BOD in mg/l for treated waste water is
(a) 150 (b) 0
(c) less than or equal to 30 (d) >30.

Group - B

2. (a) Discuss in brief the significance of Water Act 1974.

(b) A multi-tray settling chamber having 8 trays, including the bottom surface, handles 6 m^3/s of air at 20^0C. The trays are spaced 0.25 m apart and the chamber is to be 1 m wide and 4 m long. What is the minimum particle size of density 2000 kg/m^3 that can be collected with 100% efficiency? What will be the efficiency of the settling chamber if 50 μm particles are to be removed? Laminar flow condition within the chamber and presence of no dust initially on trays may be assumed.

4 + (4 + 4) = 12

3. (a) Explain the working of electrostatic precipitator for controlling air pollution in thermal power stations.

(b) What is hazardous waste? Mention treatment technologies for hazardous waste. Enumerate the methods to reduce the production of hazardous waste from indutries.

6 + 6 = 12

Group - C

4. (a) The ultimate BOD of a river below a sewage outfall is 65.0 mg/L and the DO is at the saturation value of 10.0 mg/L. The deoxygenation

rate coefficient is 0.30/day and reaeration rate coefficient is 0.90/day. The river is flowing at a speed of 80 kms/day. The only source of BOD on this river is this outfall. Find the critical distance downstream at which the DO is a minimum? Find the minimum DO?

(b) If a wastewater treatment plant is to be built, what fraction of the BOD would have to be removed from the sewage to assure a minimum of 5.0 mg/L everywhere downstream?

(3 + 3) + 6 = 12

5. A wastewater contains the following:
150 mg/l ethylene glycol, 100 mg/l phenol, 40 mg/l sulfide (S^{2-}), 125 mg/l ethylene diamine hydrate (essentially non biodegradable).
(i) Compute the COD and TOC.
(ii) Compute the BOD_5 if the k_{10} is 0.2 /day.
(iii) After treatment, the BOD_5 is 25 mg/l. Estimate the COD (k_{10} = 0.1/day).

12

Group - D

6. (a) Discuss the management and handling methodologies of bio-medical waste in India.

(b) Write technical notes on E-waste.

5 + 7 = 12

7. Describe how huge industrial solid wastes (i) flyash from thermal power station and (ii) blast furnace slag from iron and steel industries can be utilised for various applications.

(6 + 6) = 12

Group - E

8. Delineate a case study on pollution control in a Distillery mentioning:
(i) Target Pollution Loads.
(ii) Treatment Technologies.
(iii) Key Issues.

(3 + 5 + 4) = 12

9. Write technical notes on:
(i) Waste Stabilization Pond.
(ii) Ranking of wastewater treatment alternative.

(6 + 6) = 12