MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : CH-301

BASIC ENVIRONMENTAL ENGINEERING AND ELEMENTARY BIOLOGY

Time Allotted : 3 Hours *Full Marks : 70*

The figures in the margin indicate full marks.

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

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following :

$10 \times 1 = 10$

i) Choose the correct alternative of MMD value (m^2/s) for a greater possibility of pollutant concentration in atmosphere

   a) < 6000
   b) > 6000
   c) < 5000
   d) > 5000.

ii) The noise threshold limit value for the sound level of 110 dB is

   a) 15 minutes
   b) 10 minutes
   c) 8 hours
   d) 2 hours.

iii) The saturated value of DO at 0°C is approximately

   a) 2 mg/L
   b) 4 mg/L
   c) 9 mg/L
   d) 14 mg/L.

iv) Minimum DO prescribed for a river stream, to avoid fish kills, is

   a) 2 ppm
   b) 4 ppm
   c) 8 ppm
   d) 10 ppm.

v) A water filled tank with organic matter and having no inlet and outlet would be categorized as

   a) CMBR
   b) CSBR
   c) PFR
   d) none of these.

vi) For maximum sustainable yield

   a) $N = K/2$
   b) $N/K = 4$
   c) $K = N/2$
   d) None of these.

vii) The unit of measuring hardness is

   a) ppm
   b) gm/litre
   c) mole/litre
   d) mole/kg.

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viii) The most unsuitable plume for dispersion of flue gas is

a) Trapping plume   b) Conic plume

c) Fumigating Plume   d) Lofting plume.

ix) The saturated adiabatic lapse rate in the troposphere is about

a) $-2.5°C/km$ b) $-5.4°C/km$

c) $-10°C/km$ d) $-20°C/km$.

x) A coagulant can be highly effective if it has

a) High charge   b) Low charge

c) Moderate charge   d) None of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following.   3 × 5 = 15

2. Prove that $BOD_t = LO(1 - e^{-kt})$

BOD_t = oxygen consumed by a waste in first t days .

LO = Ultimate carbonaceous oxygen demand.

K = BOD reaction rate constant.

3. Give a concise account of the chemical speciation of lead ? How can lead be removed from the atmosphere ?

3 + 2

4. What do you mean by 'environmental resistance' in determining population growth ? Describe step function response in a box system with a suitable diagram.   2 + 3

5. Consider the earth is flat and an isothermal body. Albedo for the earth is 0·2. Estimate the temperature of the flat earth. Given :

$S = 1372 \ W/m^2$,

$\sigma = 5·67 \times 10^{-8} \ W/m^2 \ (°K)^4$

6. Suppose the human population follows a logistic curve until it stabilizes at 15·0 billion. In 1986, world's population was 5·0 billion and its growth rate was 1·7%. When would the population reach 7·5 billion ?

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following.   3 × 15 = 45

7. a) Draw the schematic diagrams of (i) Fanning plume model and (ii) Looping plume model along with their lapse rate diagram.   2 + 2

b) State two advantages and two disadvantages of filter bag house unit.   4

c) Define Eutrophication of a pond. How can it be controlled ? 4

d) Define doubling time (T_d) in an exponential population growth. Show that $T_d = \dfrac{69 \cdot 3}{r}$

Where , r is the percent population growth rate constant and $ln\ 2 = 0 \cdot 693$. 1 + 2

8. a) Establish the relation $BOD_t = L_0(1 - e^{-kt})$, where BOD_t = amount of oxygen consumed by the waste in first t days, L_0 = ultimate carbonaceous oxygen demand and k = the BOD reaction rate constant.

b) The dilution factor P for an unseeded mixture of wastes and water is $0 \cdot 030$. The DO of the mixture was initially $9 \cdot 0$ mg/L and after 5 days it has dropped to $3 \cdot 0$ mg/L. The reaction rate constant is $0 \cdot 22$/day.

Calculate :

(i) the 5 -day BOD of the wastes

(ii) L_0

(iii) the remaining oxygen demand after 5 days.

c) What is acid rain ? How is it formed ? Discuss its effect on environment. 4 + 6 + 5

9. a) What is meant by hardness of water ? What ions are responsible for hardness in natural hard water ? Mention the disadvantages of using hard water in boilers and laundries.

b) What is aquifer ? Mention the different types of aquifer. State Darcy's law.

c) Name the three sources of thermal pollution.

d) Mention water polluting substances produced by chemical industries, two each from organic and inorganic origin. 5 + 5 + 2 + 3

10. a) What are the effects of noise pollution ?

b) In a work area the noise levels are read as 95 dBA for 2 hrs a day, 90 dBA for 4 hrs a day, 80 dBA for remaining 2 hrs a day and permissible duration of each noise level is 95 dBA for 2 hrs, 90 dBA for 4 hrs and 80 dBA for 16 hrs. Find out the noise threshold limit value and predict whether the noise level is within Permissible limit or not ?

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c) Write the controlling measures of Noise pollution.

d) What is solid waste management ? Discuss the effect of noise pollution on public health.

$4 + 4 + 4 + 3$

11. Write short notes on any *three* of the following : 3×5

a) Electrostatic Precipitator

b) Composting

c) Logistic growth of population

d) Environmental Impact Assessment (EIA)

e) Atmospheric radiation window.

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