B.Tech 7th Semester Exam., 2015

ENVIRONMENTAL ENGINEERING—II

Time : 3 hours   Full Marks : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

(ii) There are **NINE** questions in this paper.

(iii) Attempt **FIVE** questions in all.

(iv) Question No. **1** is compulsory.

1. Choose the correct answer/Fill in the blanks (any *seven*) :   2×7=14

    (a) Diken's formula is a useful means for the estimation of
       (i) fire demand
       (ii) water loss
       (iii) rainfall intensity
       (iv) peak discharge

    (b) Minimum self-cleaning velocity for a particle of 5 mm diameter and 1·2 specific gravity should not be less than
       (i) 0·45 m/s
       (ii) 0·9 m/s
       (iii) 1·2 m/s
       (iv) 1·9 m/s

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    (c) Blue baby disease is caused due to consumption of water contaminated with
       (i) ammonia
       (ii) nitrate
       (iii) nitrite
       (iv) sulphate

    (d) The main objective of secondary treatment of municipal wastewater treatment is
       (i) removal of biodegradable organic compound
       (ii) removal of nitrogenous compound
       (iii) removal of pathogens
       (iv) All of the above

    (e) A sedimentation tank under normal condition may remove suspended solids from
       (i) 30% to 35%
       (ii) 50% to 55%
       (iii) 60% to 65%
       (iv) 80% to 85%

    (f) The land requirement for the oxidation ditch is generally more than the oxidation pond.
       (i) True

(g) Equation for determination of efficiency of a single-stage high-rate trickling filter is _____.

(h) Disease-causing bacteria present in drinking water is known as _____.

(i) A leaching cess pool is used for the disposal of _____.

(j) The second-stage BOD is due to presence of _____.

2. (a) Derive an expression to determine the hydraulic mean depth of a circular sewer, which is (i) running partially full, and (ii) running full.

(b) The following data is available regarding various types of area and the corresponding impermeability factors of a town :

Type	Area (in %)	Impermeability coefficient (K)
Roots	15%	0·9
Pavements	20%	0·8
Vegetation	40%	0·15
Unpaved	15%	0·20
Wooded	10%	0·05

Determine the average coefficient of runoff. If the total area of the district is 20 hectares, determine the maximum storm water flow for a rainfall intensity of 50 mm/hr.

14

(4)

3. Differentiate between BOD and COD. A 2% solution of sewage sample is incubated for 5 days at 20 °C. The depletion of oxygen was found to be 4 mg/L. Calculate the ratio of BODs at 20 °C and 25 °C.

[Assume K_D at 20 °C = 0·1]   14

4. (a) What do you understand by population equivalent? Explain in brief.

(b) 125 cumec of sewage of a city is discharged in a river which is fully saturated with oxygen and flows at a minimum rate of 1600 cumec with minimum velocity of 0·12 m/s. If the 5 days BOD of the sewage is 300 mg/l, find out where the critical DO will occur. Assume—

Coefficient of purification of river = 4·0;

Coefficient of DO = 0·11;

Ultimate BOD is 125% of the 5 days BOD of the mixture of sewage and river water.   5+9=14

5. (a) Draw a flow diagram of municipal wastewater treatment plant useful for large-sized cities.

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(**5**)

(b) Design a suitable grit chamber-cum-detritus tank for a sewage treatment plant getting a dry weather flow from a separate system @ 400 L/s. Assume the flow velocity through the tank as 0·2 m/s and detention period of 2 minutes.   14

6. Design a circular settling tank unit for a primary treatment of sewage at 12 million litre per day. Assume detention period of 2 hours and surface loading as 40000 L/sq m/day. Also show various components of the tank with the help of neat sketch.   14

7. With the help of plan and sectional elevation, show various components of a septic tank. Also discuss briefly the important design considerations which must be taken in account during designing of a septic tank.   14

8. Determine the size of a high-rate trickling filter for the following data :   14

   Sewage flow = 4·5 MLd

   Recirculation ratio = 1·5

   Influent BOD = 250 mg/L

   BOD removal in primary tank = 30%

   Effluent BOD = 30 mg/L

K16/381   (*Turn Over*)

(**6**)

9. (a) What do you understand by sludge volume index? Discuss in brief.

(b) Design an oxidation pond using the following data :

   Population = 5000

   Sewage generation = 120 L/c/d

   BODs of sewage = 300 mg/L

   Organic loading = 300 kg/ha/d

                    6+8=14

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