

B.Tech 6th Semester Exam., 2015**ENVIRONMENTAL ENGINEERING—I**

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 option (any seven) : $2 \times 7 = 14$

(a) According to IS 10500 : 1991; the desirable limits for pH in drinking water is

- (i) 7
- (ii) 7-8
- (iii) 7.5-8.5
- (iv) 6.5-8.5
- (v) None of the above

(b) DDT has property of

- (i) bioaccumulation
- (ii) biomagnification
- (iii) endocrine disrupting agent
- (iv) All of the above

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(Turn Over)

(c) Displacement efficiency of a sedimentation tank may defined as

- (i) flowing through period/detention period
- (ii) detention period/flowing through period
- (iii) 1/detention period
- (iv) None of the above

(d) Coincident draft is

- (i) maximum hourly demand plus maximum daily demand
- (ii) maximum hourly demand plus fire demand
- (iii) maximum daily demand plus fire demand
- (iv) fire demand

(e) Drinking water supply scheme for Patna Municipal area is based on

- (i) surface water drawn from Ganga river
- (ii) surface water drawn from Sone river
- (iii) groundwater
- (iv) All of the above

(Continued)

(3)

- (f) Adsorption process may be adopted for the removal of
- (i) hardness
 - (ii) turbidity
 - (iii) color
 - (iv) All of the above
- (g) BOD value of potable water should be
- (i) zero mg/L
 - (ii) 5 mg/L
 - (iii) 20 mg/L
 - (iv) 30 mg/L
- (h) Jaundice is caused by
- (i) bacterial infection
 - (ii) viral infection
 - (iii) hormonal infection
 - (iv) None of the above
- (i) In drinking water distribution network, which valve is required to be installed at all summits?
- (i) Side valve
 - (ii) Air valve
 - (iii) Sluice valve
 - (iv) Gate valve

- (j) The method employed for the determination of hardness is

- (i) SPAND
- (ii) DPT test
- (iii) EDTA
- (iv) MPN

2. (a) With the help of flow diagram, show the connections of various components involved in supplying drinking water to a city, when the source of water is a river.

(b) A water supply scheme has to be designed for a city having population of 100000. Estimate the important kinds of draft namely average daily draft, maximum daily draft, maximum hourly draft and coincident draft employing 250 lpcd average water consumption.

$$6+8=14$$

3. (a) Derive an expression for the settling velocity of a spherical particle in liquid when the Reynolds number is less than 0.5.

(Continued)

(5)

- (b) For a continuous flow settling tank of 3 m deep and 60 m long in size, calculate the flow velocity of water for effective removal of 0.025 mm particle at 25 °C. (sp. gravity of the particle = 2.65, kinematic viscosity of water at 25 °C = 0.01 cm²/sec) 7+7=14

4. (a) How do you determine the optimal dose of a coagulant in laboratory?

(b) Indicate the various components of a slow sand filter with the help of a neat sketch. 7+7=14

5. Determine the dimensions of a rapid sand filter having capacity to treat 4 mld water per day. Also design a suitable under-drain system and wash water troughs for efficient functioning of the filter unit. 14

6. (a) A water treatment plant consists of the unit processes coagulation, flocculation, sedimentation, filtration and disinfection. The suspended solids concentration of the raw water is 500 mg/L and the plant treats 36400 m³/d. Alum [Al₂(SO₄)₃ · 14H₂O] is used as a coagulant with a dose rate of 500 mg/L. Compute the sludge solids produced daily if complete reaction of

alum to aluminium hydroxide [Al(OH)₃] occurs and 98% total solids are removed by sedimentation unit. (Molecular weight : Al = 27, S = 32, O = 16, H = 1)

- (b) Calculate the hardness in mg/L as CaCO₃ of the following water sample :

Cation	Concentration (mg/L)	Molecular wt.
Na ⁺	15	23
Mg ²⁺	9	24.4
Ca ²⁺	48	40

9+5=14

7. (a) What do you understand by break-point chlorination? Describe in brief.

- (b) Results of chlorine demand test on raw water are given below :

Sample No.	Chlorine dose (mg/L)	Residual chlorine after 10 minutes contact (mg/L)
1	0.2	0.19
2	0.4	0.36
3	0.6	0.50
4	0.8	0.48
5	1.0	0.20
6	1.2	0.40
7	1.4	0.60
8	1.6	0.80

Determine the break-point chlorine dose and chlorine demand. 6+8=14

8. A town with a population of one lakh is to be supplied with water daily at 200 litres per head. The variation in demand is as follows :

6 a.m. to 9 a.m.	40% of total
9 a.m. to 12 noon	10% of total
12 noon to 3 p.m.	10% of total
3 p.m. to 6 p.m.	15% of total
6 p.m. to 9 p.m.	25% of total

Determine the capacity of the service reservoir employing (a) mass balance curve and (b) analytical method for 12 hours uniform pumping rate from 6 a.m. to 6 p.m. 14

9. (a) Water has to be supplied to a town with one lakh population at a rate of 150 lpd from a river 2000 m away. The difference in elevation between the lowest water level in the sump and reservoir is 36 m, if the demand has to be supplied in 8 hours, determine the size of the mains and the brake horse power of the pumps required. Assume maximum demand as 1.5 times the average demand, $f = 0.0075$, velocity in pipe 2.4 m/s and efficiency of pump 80%.

- (b) Two power generator sets namely A and B have capacity to produce noise 80 dB and 83 dB respectively. Find out the noise level at the place where both the generators running simultaneously.

$$7+7=14$$
