

Code : 011618

B.Tech 6th Semester Exam., 2016

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 from the following
(any seven) : $2 \times 7 = 14$

(a) Aeration of water is employed for removal of

- (i) hardness
- (ii) alkalinity
- (iii) iron
- (iv) oxygen

(b) In the design of sedimentation tank, the most essential factor considered is

- (i) surface loading
- (ii) depth of tank
- (iii) retention time of tank
- (iv) turbidity

(2)

(c) Methemoglobinemia is caused by excess of the following in drinking water :

- (i) Fluorides
- (ii) Sulphates
- (iii) Phosphates
- (iv) Nitrates

(d) Which of the following are the common problems associated with operation of rapid sand filter?

- (I) Air binding
- (II) Mud ball formation
- (III) Zoogeleal layer development
- (IV) Cracking of sand beds
- (i) (I) and (II)
- (ii) (II) and (III)
- (iii) (I), (II) and (IV)
- (iv) (I), (II), (III) and (IV)

(e) The electrical conductivity generally _____ with increase in total dissolved solids in water.

- (i) increases
- (ii) decreases
- (iii) increases initially then decreases
- (iv) decreases initially then increases

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(3)

- (f) Summits are points of
- (i) high pressure
 - (ii) low pressure
 - (iii) equal pressure
 - (iv) None of the above
- (g) Ethyl diaminetetraacetic acid is used to determine ____ of water.
- (i) alkalinity
 - (ii) dissolved oxygen
 - (iii) residual chlorine
 - (iv) hardness
- (h) Jet pumps are used for
- (i) pumping water from state tube wells
 - (ii) pumping water into distribution mains with large distances
 - (iii) pumping water from small bore well with low water table
 - (iv) None of the above
- (i) In design of water conduits, selection of smaller velocity will result in
- (i) increase of pipe cost
 - (ii) increase in pumping cost
 - (iii) Neither (i) nor (ii)
 - (iv) Both (i) and (ii)

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(Turn Over)

(4)

- (j) ____ is a unit used to measure the loudness of sounds.

- (i) Decibel
- (ii) Watt
- (iii) Pitch
- (iv) RAM

2. (a) Explain the concept of indicator organism in the determination of bacteriological quality of water. What are the reasons for selecting *E.coli* as the indicator organism for water quality?

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- (b) A new town A is coming up in Madhya Pradesh which is expected to grow with a rate similar to town X. Town X started developing as a new town in 1941 and its population grew as per the data given below :

Year	1941	1951	1961	1971	1981
Population	196415	283479	364594	475300	813963

The population of town A, as described above, is 200000 in 2016. Explain, with reasons, the growth model you will apply for population forecasting of town A and forecast the population of town A for a water supply scheme with period of design as 30 years.

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(5)

3. (a) Draw a neat flow diagram for treatment of drinking water sourced from surface water with justification of each treatment unit employed for the treatment. 6
- (b) For water supply of a small town with daily requirement of 225000 litres, it is proposed to build a distribution reservoir. The pattern of draw of water is as follows :
- 7:00 AM-8:00 AM : 30% of daily supply
 8:00 AM-5:00 PM : 35% of daily supply
 5:00 PM-6:30 PM : 30% of daily supply
 6:30 PM-7:00 AM : 5% of daily supply
- The pumping is to be done for 8 hours per day between 8:00 AM to 4:00 PM. Determine the storage capacity of reservoir. 8
4. (a) Give a neat sketch of a rapid sand filter and explain the operation sequence of valves during normal filtration and backwashing. 6
- (b) A 300 m^3 rectangular primary sedimentation tank receives water containing 100 mg/l of single-size spherical suspended particle of diameter 0.5 mm and specific gravity 2.65 at 20°C at a rate of 10^9 liters per

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(6)

- day. Depth of water in tank is 3 m . The settling velocity of particle was found to be 0.093 m/s . Calculate the amount of suspended solids in this water after primary sedimentation, weight of dry settled particles produced per day from this primary sedimentation tank. Also, calculate the length and width of tank assuming length : width as $3 : 1$ if the primary sedimentation tank had 100% removal efficiency. 8
5. (a) Explain the terms free available chlorine, combined chlorine and break-point chlorination. 6
- (b) For disinfecting water supply, it is required to treat 400000 litres of daily water supply with 0.5 mg/l of chlorine. The disinfectant is available in form of bleaching powder containing 30% available chlorine. Calculate the amount of bleaching powder required to treat the water. 8
6. (a) Describe with chemical reactions any two coagulants used for treatment of drinking water. 6
- (b) A water treatment plant is to process $30000 \text{ m}^3/\text{day}$ raw water. The rapid mixing tank will blend 35 mg/l alum with the flow and is to have detention

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(7)

time of 2 min. The tank is to have square cross section. Determine—

- (i) quantity (kg per day) of alum added;
- (ii) power input (kilowatts) necessary for G value of 900 per second. 8

7. (a) What are the different impacts of noise pollution? 7

(b) Discuss the regulatory guidelines for noise pollution. 7

8. (a) Define hardness of water, its various types and explain its significance in context of water supply for domestic and industrial purposes. 6

(b) Lime soda process was employed for softening of water supply of 100000 litres of raw water per day. The water had following composition :

Dissolved $\text{CO}_2 = 39.6 \text{ mg/l}$

$\text{Ca}^{++} = 44 \text{ mg/l}$

$\text{Mg}^{++} = 18 \text{ mg/l}$

$\text{Na}^+ = 16 \text{ mg/l}$

Alkalinity (HCO_3^-) = 122 mg/l

Calculate the requirements of lime and soda per day. 8

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(8)

9. Write short notes on any four of the following : $3\frac{1}{2} \times 4 = 14$

- (a) Importance of fluorides in drinking water
- (b) Fire demand and coincidental draft
- (c) Intermittent vs. continuous supply of water
- (d) Intake well
- (e) Coagulant aids
- (f) Jar test
- (g) Effects of noise pollution on people's health

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