CBCS SCHEME

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18CV46

Fourth Semester B.E. Degree Examination, June/July 2023
Water Supply and Treatment Engineering

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Draw neat diagrams wherever required.

Module-1

1 a. Define "per capita demand". How is it estimated? Discuss the factors that influence the per capita demand. **(08 Marks)**

b. Discuss the decreasing rate of growth method and the logistic curve method of population forecasting **(06 Marks)**

c. A water supply scheme has to be designed for a city having a population of 2.5 lakhs. Estimate the important kinds of drafts which may be required to be recorded for an average water consumption of 180 lpcd. Also record the required capacities of major components of the proposed water works system for the city using a river as a source of supply. Assume suitable data, wherever needed. Take maximum daily draft as 1.8 times the average. **(06 Marks)**

OR

2 a. Explain the terms:
i) Fire demand ii) Coincident draft iii) Whole some water iv) Design period **(08 Marks)**

b. Enumerate the significance of public water supply scheme in the present-day civil life. **(06 Marks)**

c. The population of a locality as obtained from census report is as follows:

Census year	1971	1981	1991	2001	2011
Population	3,50,000	4,66,000	9,94,000	15,60,000	16,23,000

Estimate the population in the locality in the year 2021 and 2041 by incremental inverse method. **(06 Marks)**

Module-2

3 a. Discuss the objectives of water treatment. With a flow chart, explain the significance of each unit in the process of water treatment. **(08 Marks)**

b. With a neat sketch, explain the working of an infiltration gallery. **(06 Marks)**

c. Enumerate the significance of the following from water quality criteria:
(i) Chlorides (ii) Hardness (iii) E-coli **(06 Marks)**

OR

4 a. Compare the surface and sub-surface sources of water with respect to available forms, quality and quantity. **(08 Marks)**

b. With a neat sketch, explain the working of a wet intake tower. **(06 Marks)**

c. Write short notes on :
(i) Specific conductivity of water (ii) Turbidity of water **(06 Marks)**

Module-3

5 a. With a neat sketch, explain the various components of a coagulation-sedimentation tank. **(08 Marks)**

b. Compute he settling velocity of a discrete particle in water under the condition when Reynolds number is less than 0.5. The diameter and specific gravity of the particle is 0.05mm and 2.65 respectively. Temperature of water is 20°C and kinematic viscosity of water is 1.01×10^{-2} m^2/sec. **(04 Marks)**

c. Design a rapid sand filter unit for treating and MLD of water. Assume 4% of filtered water is used for washing water everyday for a period of 30 minutes. Take length of filter bed as 1.5 times the width and rate of filtration as 5,000 litres/hour/sq.m. **(08 Marks)**

OR

6 a. Explain the mechanism of filtration. **(06 Marks)**

b. Design six slow sand filter beds from the following data:
Population to be served : 50,000 persons ; Per capita demand : 150 litres/head/day
Rate of filtration : 180 litres/head/sq.m ; Length of each bed : Twice the breadth.
Assume maximum demand as 1.8 times the average daily demand, and one unit, out of six, will be kept as standby. **(06 Marks)**

c. A rectangular sedimentation tank is to handle 12 MLD of raw water with length equal to twice its width. The particles are larger than 0.04 mm in size. Assuming the specific gravity of the particles as 2.65 and the temperature as 20°C, determine the tank dimensions. If the depth of the tank is 4m, compute the detention time. **(08 Marks)**

Module-4

7 a. Compare lime-soda process with zeolite process of softening water under the following criteria:
(i) Sludge (ii) Post-Treatment (iii) pH of treated water (iv) Bacteria
(v) Hardness removal (vi) Economy. **(06 Marks)**

b. Explain :
(i) Reverse osmosis (ii) Nano-filtration **(06 Marks)**

c. Discuss :
(i) Super-chlorination (ii) Break-point Chlorination (iii) Dechlorination
Results of chlorine demand test on a raw water are given below Table 7(c). Sketch a "Chlorine demand curve". Determine the "break point dosage" and the "chlorine demand" at dosage of 1.2 mg/*l*.

Table 7(c)

Sample No.	Chlorine dosage (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	0.2
6	1.2	0.4
7	1.4	0.6
8	1.6	0.8

(08 Marks)

OR

8 a. Discuss the various forms of chlorine that can be used in disinfection process. **(06 Marks)**

b. With a sketch explain the Nalgonda Technique of defluorination of water. **(06 Marks)**

c. The analysis of a hard water shows the following composition.

Free $CO_2 = 3$ mg/l

Alkalinity = 68 mg/l

Non-carbonate hardness = 92 mg/l

Total magnesium = 15 mg/l

Assume that it is possible to remove all but 35 mg/l of carbonate hardness with lime and that the treated water is to have a total hardness of 80 mg/l. Determine the quantity of hydrated lime and soda required for treatment per million litre of raw water.

(Atomic weights in gms : Ca = 40, Mg = 24, C = 12, 0 = 16, H = 1, Na = 23) **(08 Marks)**

Module-5

9 a. Explain the types of distribution systems. **(06 Marks)**

b. Discuss the factors influencing the selection of pipe materials. **(06 Marks)**

c. Water has to be supplied to a town with one lakh population at the rate of 150 litres per capita per day from a river 2 kms away. The difference in elevation between the lowest water level in the sump and the reservoir is 36m. If the demand has to be supplied in 8 hours, determine size of the main and BHP of the pumps required. Assume maximum demand as 1.5 times the average demand, coefficient of friction of pipe material = 0.0075, Velocity = 2.4 m/sec, Efficiency of pump = 80%. **(08 Marks)**

OR

10 a. Define "economical diameter" of a rising main. Discuss how is it determined. **(04 Marks)**

b. Explain the post fire hydrant and fresh fire hydrant in a water distribution system. **(06 Marks)**

c. It is proposed to construct a distribution reservoir for the water supply of rural population with daily requirement of 2,25,000 litres. The pattern of draw-off is as follows:

7 A.M. to 8 A.M. – 30% of days supply

8 A.M. to 5 P.M. – 35% of days supply

5 P.M. to 6.30 P.M. – 30% of days supply

6.30 P.M. to 7 A.M. – 5% of days supply

Pumping has to be done at a constant rate of 8 hours per day (from 8 A.M. to 4 P.M.). Estimate the storage of capacity of the reservoir by drawing the mass curve of demand. **(10 Marks)**

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