

B.E. CIVIL ENGINEERING THIRD YEAR FIRST SEMESTER – 2024**SUBJECT: ENVIRONMENTAL ENGINEERING-I (CE/PE/B/T/311)****Time: 3 hours****Full Marks: 100****Instructions: Use Separate Answer scripts for each part.****Part - I**

Sl. No.	Question	CO	Marks
1	Find the terminal velocity at 20°C of spherical particle of 1 mm diameter, 2.65 specific gravity. Flow is 8 MLD and kinematic viscosity at 20°C is 1.01 centistoke.	[CO3]	[10]
2	The analysis of a hard water shows the following compositions: Free carbon-di-oxide: 4 mg/l; Alkalinity: 65 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 amount of hydrated lime and soda required for treatment per million litre of raw water.	[CO3]	[5]
3	Find area and dimension of a settling tank, where spherical discrete particle of dia 0.015 mm, and specific gravity of 2.65 removed 75% from a flow of 8MLD and dynamic viscosity at 20°C is 1.009 centipoise. Density at 20°C is 0.9952 gm/cc.	[CO3]	[6]
4	Find the time of exposure of water in gravity aerators falling through a distance of 4m in a) single descent b) in 4 descent	[CO3]	[3]
5	Write short note on: JAR test.	[CO2]	[3]
6	In a spray aeration process using nozzles, water is to be exposed for 2.6 seconds. Estimate the driving force required for a) vertical jet, b) jet inclined at 60° to the horizontal. Take velocity coefficient for nozzle as 0.95. Also find out the associate carry and rise in each case.	[CO3]	[8]
7	a) Explain : “pre-chlorination has become much less common practice now-a-days”. b) Why re-chlorination is needed?	[CO2]	[2+2]
8	Determine the % of HOCl in an aqueous solution, $[OCl^-]$ and $[HOCl]$ at a temperature 20°C, $pH = 8.5$, $K_{OCl} = 2.5 \times 10^{-8}$	[CO3]	[3]
9	A water with low alkalinity of 10 mg/L as $CaCO_3$ will be treated with the alum lime coagulation (alum as coagulant and lime as coagulant aids). Alum dosage is 52.2 mg/L. Determine the lime dosage needed to react with alum.	[CO3]	[5]
10	Describe the difference between orthokinetic and perikinetic flocculation.	[CO2]	[3]

[Turn over

B.CIVIL ENGG. 3rd YEAR 1ST SEM. EXAMINATION 2024

Environmental Engineering I

Time: 3 hours

Full Marks 100
(50 marks for this part)**Part-II**

Question no. 1 is compulsory
 Answer any **two** from the rest
Hazen-William's nomogram is allowed
(Assume any data, if required, reasonably)

1. Answer the following questions

- I. Discuss the importance of rainwater harvesting in present context. 3 (CO1)
- II. Discuss the applicability of Arithmetic, Geometric and Decrease rate of increase methods of population projection. 4 (CO1)
- III. Discuss about the factors affecting municipal water demand. 4 (CO1)
- IV. For same demand pattern, how the capacity of the distribution reservoir can be optimized by pumping? 3 (CO4)
- V. What are the advantages of 'ring main system' of water distribution networks? 3 (CO4)
- VI. Specific gravity of a sulfuric acid is 1.84 and contains 98% by weight of H₂SO₄. Find out the molarity and normality of the acid. 3 (CO1)

2. Deduce the equation for 'Incremental increase method' of population projection and with this method, solve the following problem.

The populations of a town as per the Census records are given below for the years 1961 to 2021. Assuming that the scheme of water supply will commence to function from 2025, it is required to estimate the population of 30 years and also the intermediate population of 15 years after 2025.

Year	1961	1971	1981	1991	2001	2011	2021
Population	41,750	42,346	60,533	76,464	98,923	123,720	158,671

15 (CO1)

3. A system of pipe network as shown below carries a total flow of $3 \text{ m}^3/\text{min}$ from 'A' to 'E'. Compute the total head-loss and an equivalent pipe of 300Ø between 'A' and 'E'. Consider C_H for all pipes is 100.

Pipe segment	Length (m)	Diameter (mm)
AB	800	250
BC	4000	150
CD	1600	120
BD	1200	100
DE	600	200

15 (CO4)

4. i) Why with the increase of population, 'peak factor' of municipal water demand decreases?
 ii) How and why the value of coefficient of ISO formula [for the estimation of fire demand] 'C' varies for different building materials?
 iii) Discuss about the test for the Most Probable Number (MPN) of microorganisms in drinking water.
 iv) Discuss about the Arsenic and Fluoride pollution in Indian ground water along with their health effects and drinking water standards.

3+3+4+5 (CO1)