M.E. CIVIL ENGINEERING FIRST YEAR FIRST SEMESTER EXAM 2025
Subject: WATER SUPPLY AND TREATMENT (EE)
Part - I
(60)

Use a separate Answer-Script for each part

No. of Questions	Answer all the Questions	Marks
1 (a)	Design a tube settler module of square cross section with the following data: Average design flow = 150 m^3/hr Cross section of square tubes = 30 mm x 30 mm Length of tubes = 0.75 m Thickness of tubes = 1.5 mm Angle of Inclination of tubes with horizontal = 40° Diameter of particles to be removed 100% = 0.025 mm Specific gravity of particles = 2.60 Kinematic viscosity of water = 1.02 centistoke. Also find sizes for an equivalent rectangular sedimentation tank which will provide same removal efficiency as given by the tube settler module.	[20]
2 (a)	Describe different types of sedimentation with their application.	[5]
(b)	Compute the terminal settling velocity of a spherical particle with diameter 0.6 mm and specific gravity 2.5 settling through water at 22°C temperature. Given: Kinematic viscosity of water = 0.962 centistoke. Show detailed calculation upto and including 3rd iteration.	[6]
(c)	Deduce an expression for 'critical fall velocity' for the flow through an inclined circular tube settler in terms of known variables using Hagen-Poiseuille equation for flow $$Q = \frac{\pi h \rho g R^4}{8 \mu l}$$ the terms having their usual meanings.	[9]

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3 (a)	In an experiment on the removal of CO_2 from water sprayed into the air in spherical droplets of 0.5cm in diameter. The initial super-saturation of the water with CO_2 was 25.8 mg/L. After 1.2 sec of exposure, this was reduced to 11 mg/L. Find the co-efficient of gas transfer (k_g) and proportionality factor (k_La).	[10]
(b)	Derive the expressions for rate of free fall for single descent and multiple descents in gravity aerators. Find the time of exposure of water in gravity aerators falling through a height of 3.3m in four descents.	[10]

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M.E. CIVIL ENGINEERING 1st YEAR 1st SEMESTER EXAMINATION, 2025

WATER SUPPLY AND TREATMENT (EE)

Time: Three hours

Full Marks 100
(40 marks for part I)

Use a separate Answer-Script for each part

Part-II

Question no. **1** is compulsory
Answer any **two** from the rest
(Assume any data, if required, reasonably)

1. Answer the following questions (3+3+4+4+6) = 20

I. Discuss the effect of pH on alkalinity and hardness.

II. Discuss Significance of hydrogen bond.

III. What are the different types of adsorptions and their predominant forces?

IV. What are the different forms of nitrogen may present in the contaminated river water? Show their distribution with time.

V. Describe the test for the Most Probable Number (MPN) of microorganisms in drinking water. How MPN table is used for determination of most probable number of coliforms per 100 ml of sample? If expected MPN of coliforms per 100 ml of sample is around 2800 then what will be the serial sample volumes?

2.

a) Compute the ionic strength of a solution containing 0.10 M $MgCl_2$ and 0.20 M $Al_2(SO_4)_3$. Also calculate the activity coefficient and activity of Mg^{++} and Al^{+++} ions in the solution using the Guntelberg relationship. 4

b) What is half reaction? Discuss the importance of redox potential in half reaction. Develop appropriate half reactions, and from these constructs the complete oxidation-reduction equation. Oxidation of CH_3COO^- to CO_2 and reduction of $Cr_2O_7^{2-}$ to Cr^{3+}. 6

3. A liter solution is prepared by dissolving 0.12 mole of H_2S and 0.12 mole of HCl in water. Calculate the $[H^+]$, $[HS^-]$ and $[S^=]$ in the solution and also calculate pH of the solution. ($K_1 = 1.1 \times 10^{-7}$, $K_2 = 1 \times 10^{-14}$).

10

4. 2×10^{-2} mole mass of acetic acid is added to sufficient water to make 2 liters of solution at 25°C. Indicating the different stapes find out the equilibrium concentration of all species involved? Ignore activity corrections. Given $K_A = 1.8 \times 10^{-5}$ at 25°C.

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