Ref No. –EX/PG/CE/ T/111D/2018

P.G. CIVIL ENGINEERING EXAMINATION, 2018
I ST YEAR, 1ST Semester Examination

SUBJECT: WATER SUPPLY & TREATMENT

Full Marks ~~30~~/100

Time: ~~Two hours~~/Three hours/~~Four hours/ Six hours~~

Use a separate Answer-Script for each part

No. of Questions	Part I (Marks:60)	Marks

Answer Any three (3) questions.
Assume relevant data if necessary.

Q 1 .

a) What are the different impurities normally present in natural water sources? How these impurities are removed to render water fit for potable purpose? Draw a neat flow diagram as necessary to justify your answer. State also the function of each unit. (7)

b) An experiment was conducted on the removal of CO2 from water which was sprayed into the air in spherical droplets of 6mm in diameter. In an exposure of 1.25 secs,the super saturation of the water with CO2 was found to be 10 mg/L. Estimate the initial super saturation. Assume gas transfer co-efficient as 250 cm/hr. (7)

c) Estimate the time of exposure of water in cascade aerator for falling through 4m height in 4 descents. Derive the necessary equation also for solving the problem. (6)

Q2.

a) Estimate the magnitude of driving head that will expose water for a water jet inclined at 45 degree for 2.5 sec. Find also the associated rise and carry. Assume velocity co-efficient of the nozzle as 0.92. (7)

b) Discuss the theory of bubble aeration and establish the relationship between time of exposure and concentration of effluent. (6)

c) Estimate the desired settling velocity of a particle in water if the size of the particle is .0.20 mm. assume kinematics viscosity 0.90 centistokes at 25 degree Celsius. Check also the application of the Newton's aw for the above problem. (7)

Q3.

a) Why colloid particles produce stable turbidity in water?
What is meant by flocculent settling? (4)

b) What is " G "? Why they are so important during mixing of coagulants in water? Derive an expression for G value with power driven by mixing device. (6)

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c) Following information are available for designing of mixing and flocculation unit. 1.
Flow rate = 5MLD
Rapid mixing time = 60sec
Viscosity of water = 1.08×10^{-3} N-sec/m^2
The depth of rapid mixing unit = 3.2 m
The depth of flocculation basin = 3.8 m
Flocculation time = 15 min

Determine
1) the power input in the above two units in KW
2) dimension of mixing and flocculation unit (10)
Assume G for fresh mixing unit 700 sec^{-1}
G for flocculation unit 35 sec^{-1}

Q4.
a) A settling column of 2.0 m depth yields the following results. 2

Time, Min: -	0	60	80	100	130	200	240	420
Concn, mg/L :-	300	189	180	156	128	111	78	27

What will be the basin efficiency of the settling tank with a loading rate of 20M ^{3}/M^2 /day? Use graphical method for solving the problem. (12)

b) Derive an expression for obtaining gas transfer coefficient on the basis of Two film theory. State the assumption for deducing the above equation (8)

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M.E. CIVIL ENGINEERING 1st YEAR 1st SEMESTER EXAMINATION, 2018

WATER SUPPLY & 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+4+4+3+6) = 20

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

   II. Discuss Significance of electro-negativity in hydrogen bond and the importance of hydrogen bond.

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

   IV. What are the differences between adsorption and absorption? What are the different types of adsorption and their predominant forces?

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

b) 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

3.

a) 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. ($K_1 = 1.1 \times 10^{-7}$, $K_2 = 1 \times 10^{-14}$).

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b) How many moles of KIO_3 must be added per liter of solution containing 0.1M Ba^{++} to bring about 99.9% precipitation of Ba^{++} as $Ba(IO_3)_2$? Given K_{sp} of $Ba(IO_3)_2$ is 1.5×10^{-9}.

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4.

a) Tests for common ions are run on a sample of water and the results are shown below. Draw the bar diagram and calculate total hardness, calcium hardness, magnesium hardness, temporary hardness, permanent hardness, carbonate hardness, non-carbonate hardness.

Constituents: Ca^{2+} = 61.3 mg/L ; HCO_3^- = 182.7 mg/L ; Mg^{2+} = 24.8 mg/L ;
SO_4^{2-} = 63.4 mg/L ; Na^+ = 65.2 mg/L ; Cl^- = 91.5 mg/L ; pH = 7.6.

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b) 2×10^{-2} mole mass of acetic acid is added to sufficient water to make 2 liter 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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