Ref No. –Ex/CE/PE/B/T/421F /2023 (S)

B.E. CIVIL ENGINEERING 4 TH YEAR 2ND SEM.SUPPLEMENTARY EXAMINATION, 2023

SUBJECT: ADVANCED WATER AND WASTEWATER TREATMENT (ELECTIVE)

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:50)	Marks
	Answer any Three (3) questions. Two (2) marks are reserved for neatness and to the point answer. Assume relevant data if necessary	
Q1. a)	State and Explain the two film theory regarding gas transfer between liquid-gaseous phases..	(5)
b)	Derive the equation .for gas transfer in following form:- $\text{Log}_e C_S - C_T / C_S - C_O = -0.4343 K_{La} t$	(6)
c)	Discuss the multiple cascade aerator for aeration process .Compare the exposure time in minutes for a cascade aerator for falling a single descent of 5m and for 5 such descents. Derive necessary equation for solving the problems.	(5)
Q 2.		
a)	In an aeration experiment on the removal of CO_2 from water by spray aeration, into the air in droplet of size 2.5 mm diameter, the initial super saturation of the water with the gas was found to be 7.8 mg/l . After 8 secs to exposure the concentration was reduced to be 0.65mg/l. Determine the gas transfer co-efficient (K_{La}).	(8)
b)	Compute the terminal settling velocity of a spherical particle with diameter 0.5 mm and specific gravity 2.5 settling through water at 22 ^oC temperatures. Given kinetic viscosity of water = 0.962 centistoke Solve the above problem upto 3rd trial	(8)
Q3. a)	A settling column of 3.0 m depth yields the following results. 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 18M^3/M^2/day? Use graphical method for solving the problem	(6) (10)

[Turn over

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Full Marks ~~30~~/100

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Use a separate Answer-Script for each part

No. of Questions	Part I (Marks:50)	Marks
Q 3. b)	Draw a neat flow diagram for a conventional treatment water treatment plant taking river as water supply source	(6)
Q 4. a)	Derive an equation for computing the head loss through filter bed under clean condition with necessary assumption and using conventional symbol of hydraulic and media parameters.	(9)
b)	A clean water is passed through a bed of uniform sand at a filtering velocity of $1.4x10^{-3}$ m/sec. The sand grains are of 0.4mm in dia and shape factor =0.85,sp .gr =2.65 with bed porosityis 0.40. Find the head loss in the bed in mm. Assume K=5.Take $\nu = 1.01x10^{-2}$ m2/sec. Compute the head loss at 0^0 C and 20^0 C. $\nu_0 = 1.79x\ 10^{-2}$ m2/sec.	(7)
Q5.	A city requires 65 MLD of potable water for which rapid gravity filter is to be designed .The backwash water is 4% of the total requirement. The operation time is 18 hrs a day out of which 60 minutes are kept for service time. Determine the following components of the filtration unit. a) No.of filter bed including 25% extra as stand bye. b) Size and No. of Laterals. c) Nos and spacing of orifices (use 15mm dia) d) Spacing of Laterals. e) Size of Manifold. f) Size of wash water tank assuming 4 m liquid depth.. Assume relevant data. Use Jenks guidelines for solving the problem.	(16)

Ref. No.: Ex/CE/PE/B/T/421F/2023(S)

B.E. CIVIL ENGINEERING FOURTH YEAR SECOND SEMESTER SUPPLEMENTARY EXAM 2023

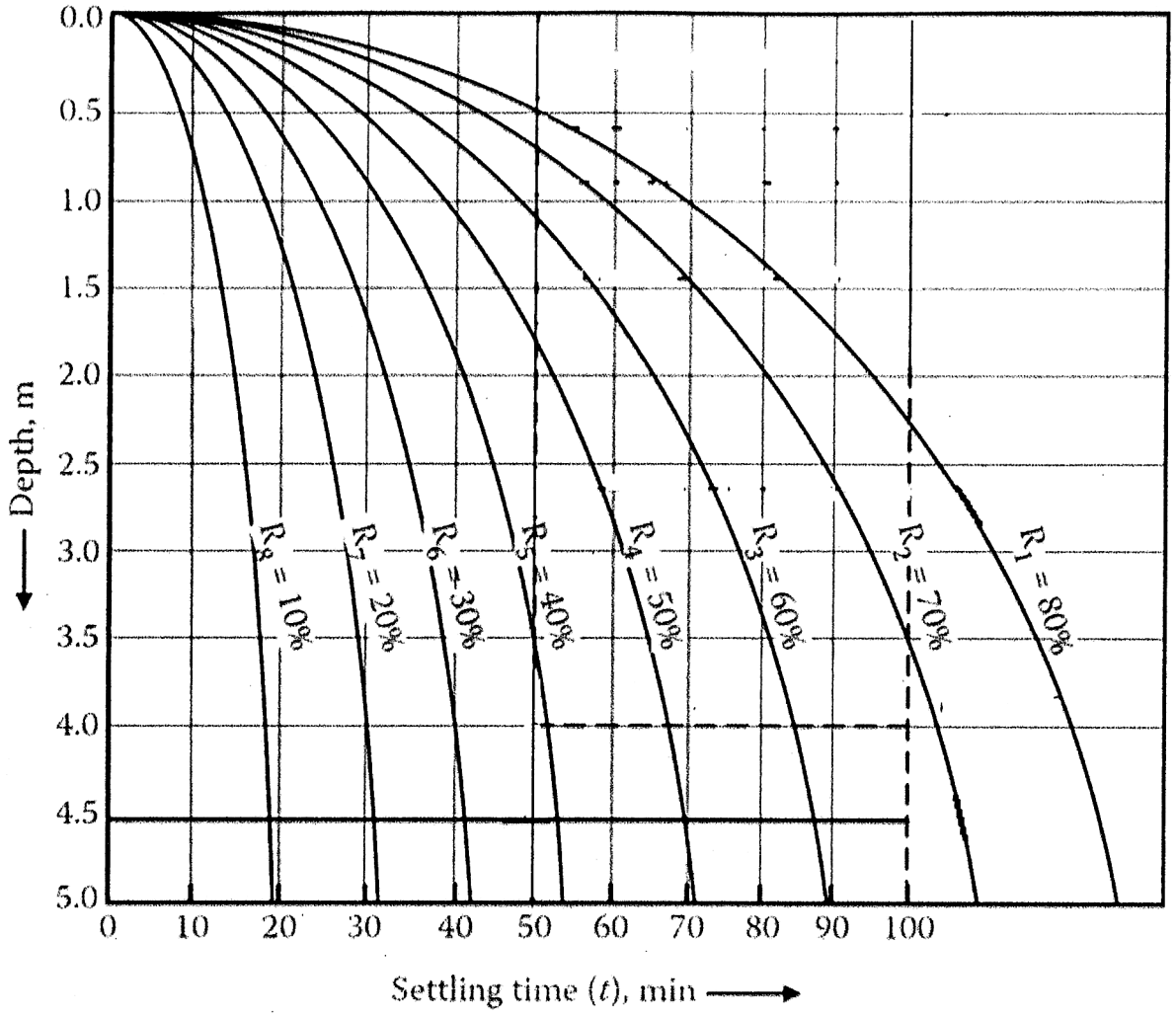
SUBJECT: ADVANCED WATER AND WASTEWATER TREATMENT

Time: 3 hours **Full Marks: 50**

Instructions: Use Separate Answer scripts for each part.

Part - II

Sl. No.	Question	CO	Marks
1	Design grit chamber for Peak wet weather flow = 1.5 m^3/s and Minimum flow = 0.25 m^3/s. Maintain constant Velocity of 0.25 m/s through the grit chamber by providing Parshall flume at the downstream end. Settling velocity in grit chamber = 0.012 m/s.	[CO2]	[15]
2	A settling column study was conducted on a wastewater sample. The column depth was 4.5 m, and initial TSS concentration of the sample was 330 mg/L. The particle isoremoval graph is given. Determine (a) Overall percent TSS removal at 60-min detention time and desired water depth of 5 m (b) Surface overflow rate (m^3/m^2 d) corresponding to 50min detention time and desired water depth of 5 m (c) Percent removal of particles at a water depth of 3.0m and 60 min detention time, (d) Detention time for 30% removal of particles at a water depth of 2.0 m, and (e) Side water depth for 40% removal of particles at a detention time of 50 min.	[C02]	[15]
3	An average operating data for conventional activated sludge process is as follows: Inflow of wastewater = 32000 m^3/d Volume of aeration tank = 12000 m^3 Influent BOD = 290mg/L Effluent BOD = 20mg/L MLSS = 2500 mg/L Effluent SS = 50mg/L Waste SS = 9200mg/L Quantity of waste sludge = 250 m^3/d Determine: a) Aeration period (h) b) F/M (Kg BOD per day/ Kg MLSS) c) % Efficiency of BOD removal d) Sludge age (days)	[C04]	[10]
4	With derivations show that for rectangular Grit chamber a proportional flow weir is required to control flow velocity.	[C02]	[10]


0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Depth, m
0
10
20
30
40
50
60
70
80
90
100
Settling time (t), min
R8 = 10%
R7 = 20%
R6 = 30%
R5 = 40%
R4 = 50%
R3 = 60%
R2 = 70%
R1 = 80%