B.E. CIVIL ENGINEERING. FOURTH YEAR SECOND SEMESTER (Old) - 2017

Subject: WATER & WASTEWATER ENGINEERING **Time: Three Hours** **Full Marks: 100 (50 for Each Part)**

Part: Part-I

Use a Separate Answer-Script for Each Part
Answer any 2 (Two) questions

1. Design a bar rack and screen chamber for fully cleaned as well as 50% clogged conditions with raised floor downstream to the bars. Also sketch a hydraulic profile through the bar rack and screen chamber. The data given is as follows: Average Flow = 50 MLD; Peak Flow = 150 MLD; Diameter of Incoming Sewer = 1.40 m; Depth of Flow in Sewer at Peak Flow = 1.05 m; Velocity in Sewer at Peak Design Flow = 1.16 m/sec; Drop of Screen Chamber Floor with respect to Sewer Invert = 0.10m; Width of Rectangular Bars = 10 mm; Clear Spacing between Bars = 25 mm; Bar Shape Factor $\beta = 2.42$; Inclination of the Bar Screen = 75^{O}. Assume any other suitable data and suitable formula as and when necessary. 25

2. Design grit chamber to remove grit particles based on the following given data. Also design a proportional flow weir (symmetrical sharp-edged; c = 0.61) which acts as a control device at the effluent point. Average Flow = 50 MLD; Peak Flow = 150 MLD; Size and Specific Gravity of the Grit Particles to be removed = 0.20 mm and 2.65; The Minimum Temperature = 15^{O}C and Viscosity $\nu = 1.14 \times 10^{-6}$ m^2/s; Efficiency of Removal $\eta = 75\%$; Measured Settling Basin Performance n = 1/8; K = 0.04 and f = 0.03. Assume any other suitable data and suitable formula as and when necessary. 25

3. (a) Applying the mass balance approach on bio-mass and food derive the driving equations for an activated sludge process with a completely mixed reactor (with a neat diagram). 5

(b) An activated-sludge system is to be used for secondary treatment of 50 MLD of municipal wastewater. After primary clarification, the BOD is 160 mg/L, and it is desired to have not more than 5 mg/L of soluble BOD in the effluent. A completely mixed reactor is to be used, and pilot plant analysis has established flowing kinetic values: Y = 0.5 kg/kg, $k_d = 0.05$/day. Assuming an MLSS concentration of 3000 mg/L and an underflow concentration of 10 kg/m^3 from the secondary clarifier. Determine the following: Volume of the Reactor; Quantity of the Secondary Sludge; The Sludge Recycle Ratio. Assume any other suitable data and suitable formula as and when necessary. 20

Ref No. –Ex/CE/T/424(E)/2017 (old)

BACHELOR OF CIVIL ENGINEERING EXAMINATION, 2017
Fourth (4^{Th}) year, 2^{nd} Semester

SUBJECT: WATER AND WASTEWATER ENGG (ELECTIVE) (old)

Time: ~~Two hours~~/Three hours/~~Four hours/ Six hours~~ Full Marks ~~30~~/100

Use a separate Answer-Script for each part

No. of Questions	Part II (Marks:50)	M
	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..	(3
b)	Derive the equation .for gas transfer in following form:- $\text{Log } C_S - C_T / C_S - C_O = -0.4343 K_{La} t$	(5
c)	Iron in Ferrous state is present in water as 1.9 mg/L. Aeration constant to the common base is 70cm/hr for diameter of droplet 25mm and saturation constant of oxygen is 7.92 mg/L. Find the time of aeration if the permissible limit of iron is 0.3 mg/L.	(8
Q 2.	Calculate the initial head loss in the sand filter of cross-section of 100 cm2 of uniform sand size of 0.5mm diameter and depth 600 mm, when operated at the filtration rate of 100L/min. and temperature of 20^0 C. Assume shape factor is 7.25. K=5, sp.gr = 2.65,$\nu = 1.01 \times 10^{-2}$ cm2/sec. Derive the equation to be used for solving the problem.	(1
Q3 . a)	A flash mixer of 2.0 m3, with a G value of 600 min^{-1} , and fluid absolute viscosity of 1.0×10^{-3} N-S/m2 is continuously operated.. What will be the power input per unit volume?.	(5
b)	Derive an expression of G with capacity of the reactor and power input.	(
c)	A settling column of 2.0 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 20M^3/M^2/day? Use graphical method for solving the problem	(

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No. of Questions	Part II(Marks:50)	Marks
Q4.		
a)	What do you mean by stock sand and filter sand? How you can prepare the filter sand from run off bank river sand?	(4)
b)	Following sieve analysis results are obtained to prepare filter bed from stock sand. Determine the size of stock sand is too coarse and below which stock sand is too fine to be rejected. The effective size of filter sand is 0.6mm and U is 1.60. Use Semi log paper.	(8)
	Size in mm, 24 17 12 8.5 6.0 4.20 3.0 2.10 1.50 1.0	
	% retained, 0 8.0 16.8 17.2 24.2 14.30 11.1 4.7 3.1 0.60	
c)	Draw a neat flow diagram for the treatment of ground water containing all plausible contamination in subsurface water . Justify with reason for proving each units.	(4)