B.E. CIVIL ENGINEERING (PART TIME) - FIFTH YEAR – 2ND SEM. EXAM. 2018 (Old)

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 = 60 MLD; Peak Flow = 180 MLD; Diameter of Incoming Sewer = 1.50 m; Depth of Flow in Sewer at Peak Flow = 1.10 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 = 20 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 = 60 MLD; Peak Flow = 180 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 60 MLD of municipal wastewater. After primary clarification, the BOD is 140 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 2800 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

B.E. CIVIL ENGINEERING (PART TIME) (Old) - 2018
FIFTH YEAR SECOND SEMESTER
Subject : WATER & WASTE WATER ENGINEERING

Time : Three Hours **Full Marks : 100** **Group / Part:**

Instructions: Use Separate Answer scripts for each Group.

Part-II (Marks:50)

Answer Question no. 1 and any two from the rest. Any relevant data may be assumed if needed.

Question No.			Question	M
1)			Answer either question **A** or **B**	
	A)	i)	Design a spray aerator given the following data: Design flow 250 m^3/hr, Iron present in the water: 0.7 mg/L, Manganese present in the water: 0.1 mg/L, saturation concentration of O_2 : 7.92 mg/L, Aeration constant (base 10): 70 cm/hr. Wind velocity is 8.5 kmph.	
		ii)	Determine the settling velocity of a discreet spherical particle in dilute suspension of size 1.2 mm, specific gravity 2.7. Given: kinematic viscosity of the suspension is 0.95 centistoke. Show detailed calculation up to and including third trial.	
	B)	i)	Discuss Electrical double layer theory in context of colloidal stability in water.	
		ii)	Well water containing some coliform organisms is to be irradiated by UV light (λ=2573 Å), as it flows through a channel of 3.0 m length and 0.6 m wide at a depth of 7.68 cm, If 30 germicidal lamp is located above the channel, so that average intensity at the water surface = 610 μwatt/cm^2, At what rate (MLD) can the water be made to flow through the channel to obtain 99.9997% removal of coliform organism. Given: coefficient of absorption at well water is 0.0565 cm^{-1} 1 watt= 14.34 calorie/min. Given that: $k_{avg} = \frac{K'''.I_0}{\alpha.x}.[1 - e^{-\alpha.x}]$ When the terms having their usual meaning.	
		iii)	A column analysis of a following suspension is run in. The initial solids concentration is 250 mg/L. At 30 min interval suspended solids samples was collected from each sampling port (spaced at 0.5 m throughout the total settling column depth of 2.0 m) and result obtained from SS concentration was given in the table. What will be the overall removal efficiency of a settling basin which is 2 m deep with a detention time of 1 hr 30 min?	

Depth (m)	Time of sampling (min)			
	30	60	90	120
0.5	133	83	50	38
1.0	180	125	93	65
1.5	203	150	118	93
2.0	213	168	135	110

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FIFTH YEAR SECOND SEMESTER
Subject : WATER & WASTE WATER ENGINEERING

Time : Three Hours **Full Marks : 100** **Group / Part: II**

Instructions: Use Separate Answer scripts for each Group.

Part-II (Marks:50)

Answer Question no. 1 and any two from the rest. Any relevant data may be assumed if needed.

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		ii)	Determine the settling velocity of a discreet spherical particle in dilute suspension of size 1.2 mm, specific gravity 2.7. Given: kinematic viscosity of the suspension is 0.95 centistoke. Show detailed calculation up to and including third trial.	
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