B.E. CIVIL ENGG. 4TH. YEAR 2ND. SEM. EXAM. - 2018

Subject: ADVANCED WATER & WASTEWATER TREATMENT **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 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 = 55 MLD; Peak Flow = 165 MLD; Size and Specific Gravity of the Grit Particles to be removed = 0.15 mm and 2.65; The Minimum Temperature = 15°C and Viscosity $\nu = 1.14 \times 10^{-6}$ m²/s; Efficiency of Removal η = 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

2. (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) Design a conventional activated sludge process to treat wastewater based on the following data: Average Flow = 55 MLD; Raw Wastewater BOD_5 = 350 mg/L; Raw Wastewater SS Concentration = 400 mg/L; Minimum and Maximum Temperature = 18°C and 32°C; Primary Sedimentation Efficiency for BOD Removal = 35%; Primary Sedimentation Efficiency for SS Removal = 65%; Primary Sludge SS Concentration = 40 kg/m³; Secondary Excess Sludge SS Concentration = 10kg/m³; Aeration Equipment Oxygen Transfer Efficiency (Standard) = 1.8 kg O_2/ kWh; BOD_5 Removal in ASP = 90%; Y = 0.5, k_d = 0.06/day, f = 0.68, C_L = 1 mg/L, C_S = 7.2 mg/L, α = 0.8. Assume any other suitable data and suitable formula as and when necessary. 20

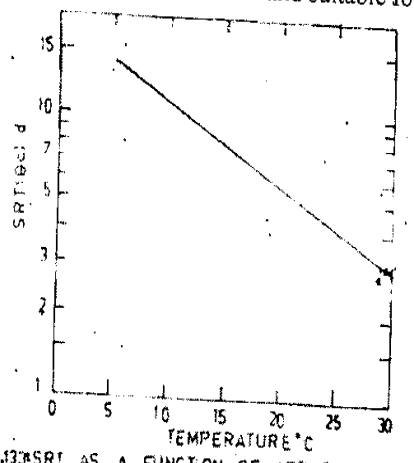

FIG.13.3 SRT AS A FUNCTION OF AERATION BASIN TEMPERATURE FOR 90-95% BOD REMOVAL

Design low rate sludge digester for digesting mixed primary and secondary activated sludge from the ASP described in Question No. 2. Additional data is given as follows: Percentage of VM in Mixed Sludge = 70%; Percentage Destruction of VM and Required HRT = 50% and 40 days; Gas Production Per kg of VM Destroyed = 0.9 m³; Condition for Minimum Surface Area Required to Avoid Foaming = 9 m³ of Gas Generated / m² / day. Assume any other suitable data and suitable formula as and when necessary. 25

Ref No. –Ex/CE/T/423(E)/2018

B.E.CIVIL ENGINEERING EXAMINATION, FOURTH YR, 2ND SEMESTER 2018

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 II (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..	(3)
b)	Derive the equation .for gas transfer in following form:- Log C_S - C_T / C_S – C_O = - 0.4343K $_{La}$ t	(6)
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.	(7)
Q 2		
a).	What is " G " ? Explain its role in chemical sedimentation.	(4)
b)	Derive an expression of G with capacity of the reactor and power input from volume element concept.	(6)
c)	A flash mixer of 2.0 m3, with a G value of 600 min^{-1} , and fluid absolute viscosity of 1.0 x10^{-3} N-S/m2 is continuously operated.. What will be the power input per unit volume of the tank?	(6)
Q3 .		
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. 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	(6)

Ref No. –Ex/CE/T/423(E)/2018

B.E.CIVIL ENGINEERING EXAMINATION, FOURTH YR, 2ND SEMESTER 2018

SUBJECT: ADVANCED WATER AND WASTEWATER TREATMENT (ELECTIVE)

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)	Marks
c)	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,v =1.01x 10^{-2} cm2/s	(6)
Q4.		
a)	A settling column of 2.5 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	(10)
b)	Compute the terminal settling velocity of a spherical particle with diameter 0.4 mm and specific gravity 2.6 settling through water at 22 ^{0}C temperatures. Give kinetic viscosity of water = 0.962 centistoke. Solve the problem upto 3rd tral.	(6)