Ref. No.EX/CE/5/T/505E/2017 (Old)

B.E. CIVIL ENGINEERING. (PART TIME) FIFTH 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 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 = 40 MLD; Peak Flow = 120 MLD; Size and Specific Gravity of the Grit Particles to be removed = 0.15 mm and 2.65; The Minimum Temperature = 15^oC and Viscosity $\nu = 1.14 \times 10^{-6}$ m^2/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 = 50 MLD; Raw Wastewater BOD_5 = 300 mg/L; Raw Wastewater SS Concentration = 400 mg/L; Minimum and Maximum Temperature = 18^oC and 32^oC; Primary Sedimentation Efficiency for BOD Removal = 30%; Primary Sedimentation Efficiency for SS Removal = 70%; Primary Sludge SS Concentration = 40 kg/m^3; Secondary Excess Sludge SS Concentration = 10kg/m^3; 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

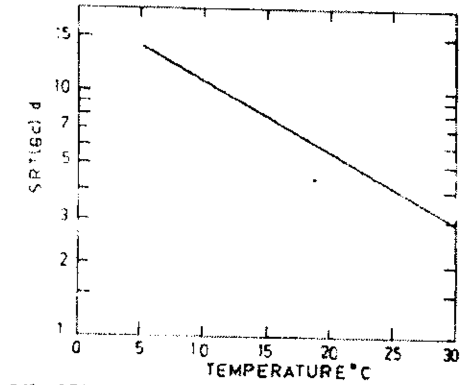

FIG.13.3: SRT AS A FUNCTION OF AERATION BASIN TEMPERATURE FOR 90-95% BOD REMOVAL

3. 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 m^3; Condition for Minimum Surface Area Required to Avoid Foaming = 9 m^3 of Gas Generated / m^2 / day. Assume any other suitable data and suitable formula as and when necessary. 25

Ref. No. Ex/CE/5/T/5054 /2017

B.CIVIL ENGG (EVENING) EXAMINATION, 2017

(5^{th} Year 2^{nd} Semester)

WATER & WASTE WATER ENGINEERING (EL-II)

Time: Three hours **Full Marks 100**

(50 Marks for each Part)

Use a separate Answer-Script for each part

HALF

(2X25=5[illegible]

<table>
<tr><th>No. Of Questions</th><th>Attempt any two questions</th><th>Marks

25X2=
50</th></tr>
<tr><td>Q1.</td><td>a) Derive the basic expression for "critical velocity" in relation to high rate sedimentation in an inclined tube settler.
b) Derive an expression for "head loss" through a clean bed of filter.</td><td>15
[illegible]</td></tr>
<tr><td>Q2.</td><td>a) Explain the two film theory of gas transfer.

b) Derive an expression for the overall gas transfer coefficient in connection to the theory of bubble aeration.

c) Derive an expression for settling velocity for a spherical particle following the fundamental theory of sedimentation.</td><td>[illegible]

09

08</td></tr>
<tr><td>Q3.</td><td>A settling analysis is run on a type-I suspension. The column is 2.0 m deep and data are shown below:

<table>
<tr><td>Time, min</td><td>0</td><td>60</td><td>80</td><td>100</td><td>130</td><td>200</td><td>240</td><td>420</td></tr>
<tr><td>Conc, mg/l</td><td>300</td><td>185</td><td>175</td><td>165</td><td>150</td><td>110</td><td>75</td><td>25</td></tr>
</table>

Calculate the theoretical removal efficiency in a settling basin with a loading rate of 30 m^3/m^2-d.</td><td>[illegible]</td></tr>
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