Ref. No.: Ex/PG/CE/T/112E/2024

M.E. CIVIL ENGINEERING FIRST YEAR FIRST SEMESTER EXAM 2024

SUBJECT: WASTEWATER TREATMENT AND DISPOSAL (EE) (PG/CE/T/112E)

Time: 3 hours **Full Marks: 60**

Instructions: Use Separate Answer scripts for each part.

Part - I

<table>
<tr><th>Sl. No.</th><th>Question</th><th>CO</th><th>Marks</th></tr>
<tr><td>1</td><td>A) Determine the value of k, K_s, μ_{max}, Y, K_d using data from a bench scale activated sludge reactor w/o recycling. In each case initial BOD is 350 mg/l.
<table>
<tr><td></td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr>
<tr><td>Final BOD</td><td>10</td><td>20</td><td>24</td><td>46</td><td>39</td><td>53</td></tr>
<tr><td>HRT (days)</td><td>3.2</td><td>2.4</td><td>1.7</td><td>1.2</td><td>1.3</td><td>1</td></tr>
<tr><td>MLVSS (mg/ltr)</td><td>130</td><td>125</td><td>135</td><td>122</td><td>135</td><td>130</td></tr>
</table>
B) Derive the Michaelis-Menten equation in connection with enzyme kinetics.</td><td></td><td>[14 + 6]</td></tr>
<tr><td>2</td><td>Design a two stage Trickling filter to treat a domestic sewage of flow 18 MLD having influent BOD_5 is 300 mg/l and desired effluent BOD strength is as per Indian standard. Also design the distribution system for the first stage TF. No need to design the under-drainage system. Assume any relevant data if needed.</td><td></td><td>[20]</td></tr>
<tr><td>3</td><td>Design a conventional activated sludge process with a flow of 40000 m^3/day, influent BOD_5 is 300 mg/l, TSS is 450 mg/l, Minimum and maximum temperature is 18°C and 32°C respectively. Primary sedimentation tank BOD and SS removal efficiency is 40% and 70% respectively. Suspended Solid concentration in primary and secondary sludge is 35 Kg/m^3 and 10 kg/m^3. Total BOD_5 and SS in the treated effluent should be $\leq$ 25 mg/l and $\leq$ 20 mg/l respectively. Assume Y = 0.5 and Kd = 0.06 day^{-1}. Assume sludge age is 7 day. Assume any relevant data if needed.</td><td></td><td>[20]</td></tr>
</table>

[Turn over

Ref No.: Ex/PG/CE/T/112E/2024

M.E. CIVIL ENGINEERING 1st YEAR 1st SEMESTER EXAMINATION, 2024

(1st / ~~2nd~~ Semester / ~~Repeat~~ / ~~Supplementary~~ / ~~Annual~~ / ~~Biannual~~)

SUBJECT: WASTEWATER TREATMENT AND DISPOSAL

Full Marks: 100

Time: ~~Two hours~~/Three hours/~~Four hours~~/ ~~Six hours~~ (40 marks for this part)

Use a separate Answer-Script for each part

No. of Question	Part-II	Marks
	Answer Question-1 and any *two* from the rest	
Q.1) a)	Draw a flowchart for a municipal sewage treatment plant showing all mandatory unit processes and operations including sludge treatment facilities.	**7**
b)	What are the significances behind the treatment of wastewater?	**3**
c)	Justify the statement with necessary mathematical expressions –"**The cross-section should be parabolic if a rectangular weir is placed at the end of the grit channel to maintain constant flow velocity.**"	**5**
d)	Discuss on the significance of **"Overflow Rate"** in the context of design of a continuous flow primary clarifier.	**5**
Q. 2)	Design a **screen chamber** on the basis of following data: *i) Peak Design Wet Weather Flow =1.279m³/sec ii) Velocity through screen at peak design wet weather flow =0.9m/sec iii) Population of the township= 2,45,000 iv) Depth of flow in the incoming conduit at peak flow = 1.16m. v) Diameter of the incoming conduit= 1.52m vi) Slope of the incoming conduit= 0.00046 vii) Velocity at peak design flow= 0.88m/sec.* **Assume any necessary data.**	**10**

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SUBJECT: WASTEWATER TREATMENT AND DISPOSAL

Full Marks: 100

Time: ~~Two hours~~/Three hours/~~Four hours~~/ ~~Six hours~~ (40 marks for this part)

Use a separate Answer-Script for each part

No. of Question	Part-II	Marks
Q.3) a)	A grit chamber is to be designed to remove particles having mean diameter of 0.2mm and specific gravity of **2.65**. The mean temperature of operation is assumed to be 25°C. A flow through velocity of 0.3 m/sec will be maintained by proportional flow weir. Determine the channel dimensions for a peak sewage flow of **13,500 m³/ day.**	**5**
b)	Design a proportional flow weir receiving a flow of **0.69** m³/sec. Consider a symmetrical sharp-edged weir and depth of flow under peak flow condition as 1.67 m. Assume the dimension of weir between 25 and **50 mm**.	**5**
Q.4) a)	What do you mean by **Grit Particles**? What are the significances of velocity control sections in the design of Grit Chambers?	**2+2**
b)	Design a suitable **rectangular primary clarifier** for treating municipal wastewater emanating from a city. The primary clarifier will comprise mechanical cleaning equipment. Assume a maximum daily water demand for the city as 12.5 MLD. Assume any other relevant data.	**6**