Ref. No.: **Ex/PG/CE/T/112E/2025**

M.E. CIVIL ENGINEERING FIRST YEAR FIRST SEMESTER EXAM 2025

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

Time: 3 hours **Full Marks: 100**

Instructions: Use Separate Answer scripts for each part.

Part – I (60 Marks)

<table>
<tr><th>Sl. No.</th><th>Question</th><th>CO</th><th>Marks</th></tr>
<tr><td>1</td><td>Design a two stage Trickling filter to treat a domestic sewage of flow 30 MLD having influent BOD_5 is 350 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>2</td><td>Design a conventional activated sludge process with a flow of 30000 m^3/day, influent BOD5 is 250 mg/l, TSS is 400 mg/l, Minimum and maximum temperature is 18℃ and 32℃ respectively. Primary sedimentation tank BOD and SS removal efficiency is 45 % and 65% 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 ≤ 25 mg/l and ≤20 mg/l respectively. Assume Y = 0.5 and K_d = 0.06 day^{-1}. Assume sludge age is 8 day. Assume any relevant data if needed.</td><td></td><td>[20]</td></tr>
<tr><td>3</td><td>Derive the Michaelis-Menten equation in connection with enzyme kinetics.</td><td></td><td>[6]</td></tr>
<tr><td>4</td><td>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, the 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>135</td><td>125</td><td>130</td><td>122</td><td>135</td><td>130</td></tr>
</table></td><td></td><td>[14]</td></tr>
</table>

[Turn over

Ref No.: Ex/PG/CE/T/112E/2025

M.E. CIVIL ENGINEERING 1st YEAR 1st SEMESTER EXAMINATION, 2025

(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.	8
b)	What are significances behind a **screen chamber** in a typical sewage treatment plant?	3
c)	Justify the statement with necessary mathematical expressions –"**The cross-section should be rectangular if a proportional flow weir is placed at the end of the grit channel to maintain constant flow velocity.**"	5
Q.2)	Design a screen chamber on the basis of following data: i) Peak Design Wet Weather Flow = **1.375m³/sec** ii) Velocity through screen at peak design wet weather flow = **0.92m/sec** iii) Population of the township = **2,75,000** iv) Depth of flow in the incoming conduit at peak flow = **1.17m.** v) Diameter of the incoming conduit = **1.49m** vi) Slope of the incoming conduit = **0.00045** vii) Velocity at peak design flow = **0.84m/sec.** Assume any necessary data.	12

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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)	Design a rectangular skimming tank on the basis of a peak design wet weather flow of **0.695m³/sec.** Assume a minimum detention period of **4 min** and the velocity of rise of air bubble of **0.22m/min.**	6
b)	Design a proportional flow weir receiving a flow of **0.68 m³/sec.** Consider a symmetrical sharp-edged weir and depth of flow under peak flow conditionas **1.66 m**. Assume the dimension of weir between **25** and **50 mm**.	6
Q.4) a)	Discuss on the significance of **"Overflow Rate"** in the context of design of a continuous flow primary clarifier.	5
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 **11.5 MLD**. Assume any other relevant data.	7