

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

SUBJECT: WASTEWATER TREATMENT AND DISPOSAL (PG/CIV/PC/T/112A)

Time: 3 hours

Full Marks: 100

Instructions: Use Separate Answer scripts for each part.

Part – I (60 Marks)

Sl. No.	Question	CO	Marks																												
1	Design a two stage Trickling filter to treat a domestic sewage of flow 25 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.		[18]																												
2	Design a conventional activated sludge process with a flow of 30000 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 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 7 day. Assume any relevant data if needed.		[18]																												
3	Design a sewer to serve an area of 25 ha with population density 300 persons/ha. Water supplied in the area = 250 lpcd. Maximum rate of infiltration = 20000 lpd/ha. Waste water reaching sewers = 90 % of water supply. Peak flow = 3.5 x Average flow. Minimum flow = $\frac{1}{3} \times$ average flow.		[11]																												
4	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 border="1" style="margin-left: 20px;"> <thead> <tr> <th></th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> <th>6</th> </tr> </thead> <tbody> <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>130</td> <td>122</td> <td>135</td> <td>130</td> </tr> </tbody> </table>		1	2	3	4	5	6	Final BOD	10	20	24	46	39	53	HRT (days)	3.2	2.4	1.7	1.2	1.3	1	MLVSS (mg/ltr)	130	125	130	122	135	130		[13]
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M.E. CIVIL ENGG. 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
<u>Answer Question-I and any two from the rest</u>		
Q.1) a)	Draw a typical flowchart for a municipal sewage treatment plant showing all mandatory/optional unit processes and operations including sludge treatment facilities.	7
b)	What are the significances of a Grit Chamber in a typical sewage treatment plant?	4
c)	Justify the statement with necessary mathematical expressions – <i>“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.”</i>	5
Q.2)	Design a screen chamber on the basis of following data: i) Peak Design Wet Weather Flow = 1.269 m ³ /sec ii) Velocity through screen at peak design wet weather flow = 0.9 m/sec iii) Population of the township = 2,58,000 iv) Depth of flow in the incoming conduit at peak flow = 1.16 m. v) Diameter of the incoming conduit = 1.52 m vi) Slope of the incoming conduit = 0.00045 vii) Velocity at peak design flow = 0.86 m/sec. Assume any relevant data.	12
Q.3) a)	Design a rectangular skimming tank on the basis of a peak design wet weather flow of 0.668m³/sec . Assume a minimum detention period of 5.0 min and the velocity of rise of air bubble of 0.23 m/min .	6
b)	Design a proportional flow weir receiving a flow of 0.685 m³/sec . Consider a symmetrical sharp-edged weir and depth of flow under peak flow conditions 1.68 m . Assume the dimension of weir between 25 and 50 mm .	6

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No. of Question	Part-II	Marks
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 11.8MLD . Assume the following: i) Detention Period= 2.0 hours ii) Horizontal flow through velocity= 0.3 m/min iii) Surface loading rate= 43 m³/day/m²	7