Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

IV SEMESTER B.TECH (CIVIL ENGINEERING)

END SEMESTER EXAMINATIONS, JUNE 2022

SUBJECT: **WASTEWATER MANAGEMENT [CIE 2254]**

REVISED CREDIT SYSTEM

(_ / 06 / 2022)

Time: 3 Hours Max. Marks: **50**

Instructions to Candidates:

- Answer ALL the questions
- Missing data may be suitably assumed

Q.No		Marks	CO
1A.	What is the role of sewer appurtenances in sewerage system? What are manholes? Classify the manhole depending upon the depth.	4	1
1B.	Briefly enumerate the various steps required for the construction of a sewer line	3	1
1C.	What is the significance of 'time of concentration' in the estimation of storm flow? A 500 mm diameter sewer pipe has been installed with an invert slope of 0.008. Determine the capacity of flow when the sewer pipe is flowing half full. The number of sewer pipes used are 2. Manning's roughness co-efficient is 0.012. Assume that the flow in the sewer pipe is uniform	3	1
2A.	What is relative stability? What is its significance? BOD at 20°C after 5 days of a sewage sample has been found to be 250mg/litre. What is its value on the 15^{th} day at 25°C? Assume K_D= 0.12/day, at 20°C.	4	2
2B.	Explain how temperature, colour, odour and pH affect the sewage characteristics	4	2
2C.	Differentiate between attached growth and suspended growth process. Give examples	2	3
3A.	Explain the stages in anaerobic process.	3	3
3B.	Explain preliminary and primary treatment of waste water with a flow sheet. Discuss the various units involved and the extent of various impurities/pollutants removed in these treatment.	4	4
3C.	Design a rectangular sedimentation tank to treatl.4 million litres of raw water per day. The detention period may be assumed to be 3 hours, depth of tank as 3m and L/B ratio as 3. Check for overflow rate and weir loading.	3	5
4A.	Explain the working principle of Activated Sludge Process with a flow diagram. State the advantages of activated sludge process.	4	4
4B.	Enlist the various operational problems in Trickling filter. Explain the control methods adopted for any one.	2	4
4C.	Design a single stage trickling filter for the organic loading of 9000Kg of BOD raw sewage per hectare meter per day with a recirculation ratio of 1.5. This filter treats the flow of 5MLD of raw sewage with BOD of 300 mg/l. Also determine the	4	5

<table>
<tr><td></td><td>strength of the effluent. Assume primary clarifier removes 35% of BOD</td><td></td><td></td></tr>
<tr><td>5A.</td><td>List the advantages of sludge digestion.</td><td>2</td><td>4</td></tr>
<tr><td>5B.</td><td>Compare the dilution and land disposal method of sewage.</td><td>3</td><td>5</td></tr>
<tr><td>5C.</td><td>A wastewater treatment plant disposes of its effluent in a surface stream. Characteristics of stream and effluent is given below. Assume saturation DO as 9.0 mg/l. Calculate the DO at $t = 0.5t_c$ and $t = 2t_c$.
<table>
<tr><td>Parameters</td><td>wastewater</td><td>stream</td></tr>
<tr><td>Flow(m3/s)</td><td>0.2</td><td>5</td></tr>
<tr><td>Dissolved oxygen, mg/I</td><td>1</td><td>8</td></tr>
<tr><td>Temperature, ° C</td><td>15</td><td>20.2</td></tr>
<tr><td>BODs at 20°C, mg/l</td><td>100</td><td>2</td></tr>
<tr><td>Oxygen consumption rate (K_1 at 20° C) (l/day)</td><td>0.2</td><td>-</td></tr>
<tr><td>Oxygen reaeration rate (K_2 at 20° C) (lI/day)</td><td>-</td><td>0.3</td></tr>
</table></td><td>5</td><td>5</td></tr>
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