

8. Write short notes on any four of the following :

- a) Respirometer for BOD determination
- b) Element of plant analysis
- c) Analysis of Tube settlers
- d) Land application of waste water
- e) Analysis of Hindered settling

Roll No

MTEE - 104

M.E./M.Tech. I Semester

Examination, December 2015

Waste Water Treatment - I

Time : Three Hours

Maximum Marks : 70

- Note :** i) Attempt any five questions.
ii) All questions carry equal marks.
iii) Any data required but not provided may be assumed suitably.
iv) Graph - paper may be supplied on demand.

1. a) Describe in detail how will you determine the BOD of industrial waste water in the laboratory.
b) State various unit operations and processes and waste water systems used to remove major contaminants found in waste water
2. a) Draw treatment process flow diagrams for
i) Activated sludge and
ii) Trickling filter
Discuss them in detail.
b) Explain how will you determine the volume requirements for equalization basin.

The following BOD results were obtained on a sample of untreated waste water at 20°C

t(days)	0	1	2	3	4	5
y mg/L	0	65	209	138	158	172

Compute the reaction rate constant 'k' and the ultimate first stage BOD using all methods.

4. For a Flocculent suspension determine the removal efficiency for a basin 3m deep with an overflow rate equal to 3m/hour, using the laboratory. Settling data presented below :

Time min.	Percent suspended solids removed at indicated depth in m				
	0.5	1.0	1.5	2.0	2.5
20	61	-	-	-	-
30	71	63	55	-	-
40	81	72	63	61	57
50	90	81	73	67	63
60	-	90	80	74	68
70	-	-	86	80	75
80	-	-	-	86	81

5. The following treated effluent is discharged to a stream :
 $Q = 30 \text{ l/s}$, $D.O = 1.5 \text{ mg/l}$, 5 day $BO_5 = 40 \text{ mg/l}$, $K_1 = 0.10/\text{day}$ and Temperature = 20°C

Upstream from the outfall the water course (River) has the following characteristics $Q = 0.2 \text{ m}^3/\text{s}$, $D.O. = 8 \text{ mg/l}$, 5-day $BOD = 2 \text{ mg/l}$ and temperature = 24°C. The stream has, $K_2 = 0.30/\text{day}$. Calculate the critical dissolved oxygen concentration down stream and distance from the outfall to this point assuming a mean velocity of 0.7m/s in the river.

6. Determine the size of outfall sewer below MH-1 needed to serve 5 hectare drainage area in figure 1. Each area has an inlet time of 10 minutes. The coefficient of run off for the two housing areas is 0.5 and the park is 0.2. The distance between manholes is 150m, and all pipes are laid on a slope of 0.0020. The rainfall intensity duration relationship is

$$i = \frac{3200}{t + 20}, \text{ where } i = \text{mm/hour and } t = \text{minutes.}$$

Use commercial size pipes

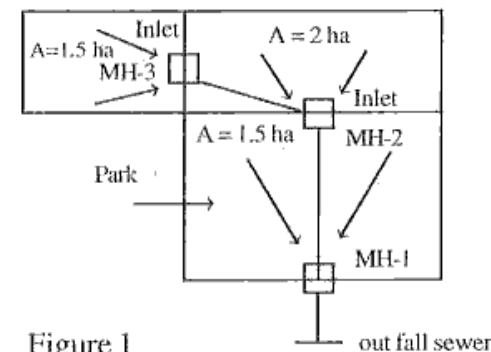


Figure 1

7. Design a flotation thickener without and with pressurized recycle to thicken the solids in activated-sludge mixed liquor from 0.3 to about 4%. Assume that the following conditions apply
- Optimum A/s ratio = 0.008 mL/mg
 - Temperature = 20°C
 - Air solubility = 18.7 mL/L
 - Recycle-system pressure = 275 kPa
 - Fraction of saturated = 0.5
 - Surface loading rate = 8 L/m².min
 - Sludge flowrate = 400 m³/d.