BACHELOR OF ENGINEERING (F.T.B.E) EXAMINATION, 2017
(4^{th} Year -2^{nd} Semester)

Waste Treatment Engineering

Time: 3 hrs. Full Marks : 100

(Use separate answer script for each part)

Part - I

(Answer question no. 1 and any other two questions from this part; 18+ 16 x 2 = 50)

1. (i) Discuss the effect of water pollution on flowing stream with a volume flow of 100ft^3/sec . What are the immediate effects and state how the water of the stream become stabilized ?

   (ii) The data given in the table below on oxygen utilization are available from the BOD tests of waste water. Obtain the values of k (rate constant) and L_0 (concentration of organic matter present initially) from the BOD equation, by using log difference method.

BOD tests of waste water:

t(day)	mg / liter of BOD y (organic matter oxidized)
0	0.0
1	9.5
2	16.7
3	20.8
4	24.8
5	28.0
6	29.2
7	31.3

(9 +9)

2. Write short notes on (any two): (8 x 2 = 16)

   (i) Electro dialysis process for separation of dissolved solids

   (ii) Use of Lagoons for purification of waste water

   (iii) Discuss the phenomenon of a typical substrate concentration and MLVS curve for a batch reactor

   (iv) Cyclic symbiotic relationship between algae and bacteria in waste water stabilization pond

3. With a neat diagram explain the working principle of a continuous anaerobic digester for production of Methane gas from liquid waste. Compare merit and demerits of single stage and double stage anaerobic digester (12 + 4)

4. What type of treatment processes are selected to treat the raw waste coming from industry containing both organic and inorganic matters? Draw the flow sheet of the treatment processes by which different types of pollutants are separated (6 + 10)

5. Why activated sludge process is chosen for treatment of huge quantity of raw waste containing a substantial amount of biodegradable matter. With proper figure explain the working principle of this process. Why this is called activated sludge process ? How MLSS concentration is maintained to a desired level to achieve a good performance.

(4 + 6 + 3 + 3)

-END-

Ref. No. : EX/FTBE/T/423/2017

BACHELOR OF ENGINEERING (F.T.B.E) EXAMINATION, 2017

(4^{th} year, 2^{nd} Semester Supplementary)

WASTE TREATMENT ENGINEERING

Time: 3 hours FM:100

Part: II

(Answer any two questions: 20x2=40)

1. Consider a suspension of soil (s=2.65) in water at 30^0 C with a uniform particle size (d=0.075mm) flow is 1.0 M gal/day.
   a) Calculate the horizontal cross section of grit chamber for obtaining removal of 70% of the particles.
   b) Suppose that instead of a uniform particle diameter, there is, besides particles of d=0.07 mm) another set with a uniformly larger diameter, which are completely removed in the grit chamber designed for 70% removal of the particles with d=0.085 mm. Determine what is the minimum particle diameter for total removal.
   c) For case (b) determine the flow-through velocity (V_{sc}) so that all particles of lower settling velocity than those completely removed are scoured away. What combination of length, width and depth for the grit chamber meets these requirements?
   Constant (β) =0.04, f (Weisbach-D'Arcy friction factor) =0.03 in this case
   (20)

2. A waste water for which the flow rate is 1.3 MGD contains of an average of 430 mg/lit of suspended solids.
   a) Design a primary clarifier of circular cross section, i.e., determine its diameter and effective depth to remove 40% of the suspended solids. Use a scale up factor 1.5
   b) Calculate the daily accumulation of sludge , amount of dry solids settled and the average pumping rate in gal/min. Plot of percentage of solids for compacted sludge versus settling time, Suspended solids removal vs (detention time and flow rate) and also plot of solids in the sludge vs. detention is enclosed.
   c) For the clarifier designed in part (a), what would be the percentage of removal of suspended solids if flow rate is doubled?
   (20)

3. Discuss the working principle of degritters. Discuss flocculent Settling. Derive a relation between terminal velocity and diameter of the waste particles during the discrete settling. (6+6+8=20)

[Enclosed Fig. are required to be attached with question as supplied data]

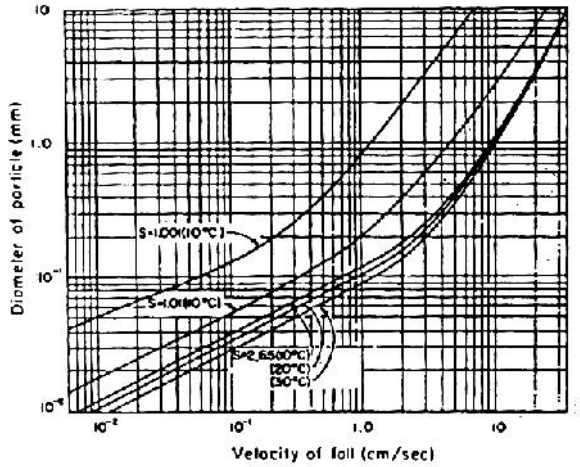

Fig. 3.4. Relation between settling velocity and particle diameter [4].

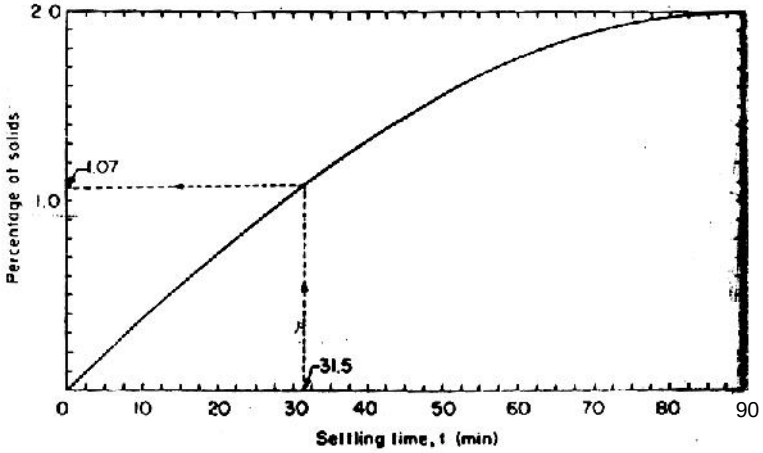

Fig. 3.22. Plot of solids in the sludge versus detention time (Example 3.4)

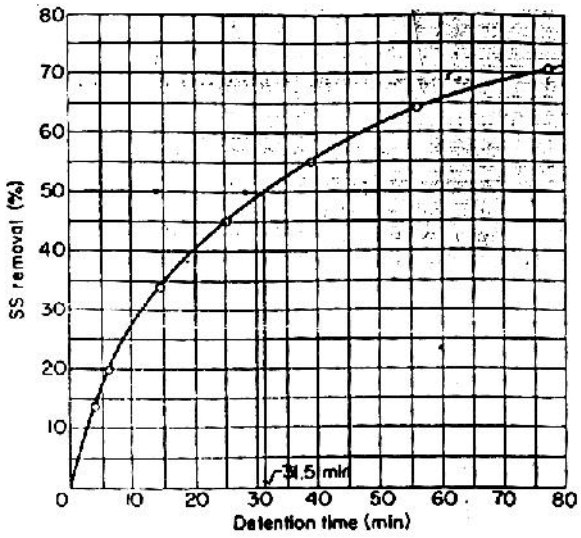

Fig. 3.16. Suspended solids removal (column 2, Table 3.7) versus detention time (column 1, Table 3.7).

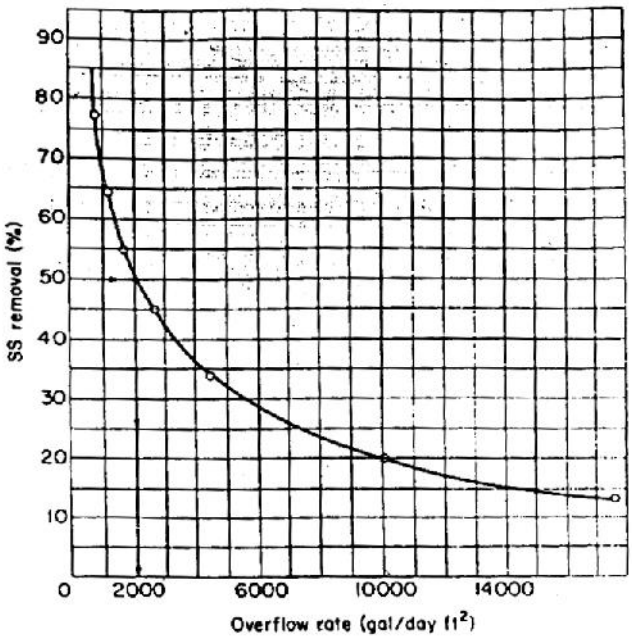

Fig. Suspended solids removal (column 4, Table 3.8) versus overflow rate (column 3,