Unit-3

PRIMARY TREATMENT OF SEWAGE

1.Define humus tank?

The efficient of the filter is therefore, passed through a sedimentation take called Humus tank otherwise called secondary clarifier or secondary setting take.

1. **What are the distinct stages in the sludge digestion processes?**
   1) Acid fermentation
   2) Acid repression
   3) Alkaline fermentation

2. **Define the term ripened sludge?**

This digested sludge (geHong from Alkaline fermentation stage)is collected at the bottom of the digestion tank and is also called repented sludge.

3. **What are the factors effecting sludge digestion** 1)Temp eruterce Thermopolis

Meropholic

2. Pit value
3. Seeding wotu digested sludge
4. Mixing and stirring of the raw sludge with digested sludge.

4. **What are functions of aeration in ASP?**
   1) oxygenation of the mixed log wor
   2) Flocculation of the colloid in sewage influent
   3) Suspension of activated sludge

5. **What are the methods employed for the purpose of certain in ASP?**

i) Diffused air aeration air aeration ii) Mechanical aeration iii) Combined diff used air and Mechanical aeration

6. What are the patterns of mechanical aeration?

i) Haworth paddle or Sheffield aeration system ii) Hartley paddle or bir Mangham Bio flocure lation system iii) Simplex aeration system iv) Link belt aeration system
v) Kessner Brush aeration system

7. **List out the important aeration processes in the ASP?**
   (1) Conventional process
   (2) Tapered aeration process
   (3) Step aeration process
   (4) Contact slabolisection process
   (5) Completely mixed process
   (6) Modified aeration

(7) Extended aeration

8. What are the advantage of stabilization ponds or cagoins

(1) Lower initial lost than required for a mechanical plant.
(2) Tower operation costs
(3) Regulation of efficient discharge possible their provoelving control of pollection during critical times of the year.

9. What are the disadvantage of tagoons?

(1) Requires extensive land area. Hence the method can be used only on rural area.
(2) If used in urban areas, expansion of town and new developments may encroach on the lagoon site.

10.What do you understand by facultative ponds?

(1) A facultative panel combine the features of the acrobite and anacrobic ponds.
(2) Constructed of intermediate depta (1, to 1.5m)
(3) A facilitative bond consists of three
  (i) A aerobic Zone -→Top
  (ii) Facilative zone
  (iii) Anacrobic zone --→ bottom

11.What are remedial measurement for rising bludge problem?

I) Increasing the return sludge age
II) Increasing the speed of the sludge scroper mechanism, where possible
III) Decreasing the mech cell residence come by increasing the sludge write rate

12.What is meant by sludge bulking?

Sludge with poor setting characteristics is termed bulking sludge. It results on poor influent due to thee presence of excessive suspended solids and also in rapid loss of MISS from tance aeration

13.What are the advantage of increment 8 and filters?

(i) The efficient from intermittent sand filter is of better quality. It is more clean and more stable and hence does not need further treatment before disposal
(ii) The filter work under acrobic conditions, and hence there is no trouble of odour, files and inserts
(iii) The operation is very simple, requiring no mechanical equipment except for dosing

14.What are the disadvantages of intermittent sand filters?

i) The rate of filtration and hence that of load long is very small per unit surface area of the filter hence they cannot be employed for medium size or bigger plants
ii) They requires large area and large quantity of sand due to which their

construction is very lostly.

15.What do you understand by contact beds?

Confact beds, also called confact filters, are similar to inter mitten sand filters in construction, except that th filtering media is very coarse, consisting of broken stones called ballart of 20 to 50mm gauge. A contact bed is a water toght take of masonry walls and of rectangular shape.
The depth of filtering media is kept b/w 1 to 1.8m

16.What are the operations involved in the contact beds?

1. filling
2. Contact
3. Emptying
4. Oxidation

17.What are the advantage of contact of beds?

i) Contact beds can work under small heads. ii) Contact beds can be operated without exposing the sewage efficient to view.
iii) There is no nuisance of filter flows iv) The problem of odour is much less as compared to trill long filters.

18.What are the disadvantage of contact beds in T.F?

i) Rate of loading is mech less in comparison to trilling filters. ii) Large areas of land is required for their installation iii) intermittent operation requires continceoces attendance iv) The cost of contact beds is mech more as compared to trickling filters.

19.What do you mean by tracking filters?

Tricking filters, also as percolating filters or sprinkling filters or sprinkling filters are similar to contact beds in construction, but their operation is confinceous and they allow constant aeration In this system sewage is allowed to sprinkle or trickle over a bed of coarse, rough hard filter media and it is then collected through the under drainage system

20.What are the purpose of under drainage system?

The purpose of under drainage system is two fold

(i) to carry away the liquid efficient and sloughed biological solids.
(ii) To distribute air through the bed

21.What are the merits of conventional trickling filter?

1) The efficient obtained from truckling filters is highly nitrified and stabilized. The efficient can there fore be disposed of in smaller quantity of deputation water
2) It has good dependability to produce good efficient under very widely varying whether and other conditions
3) The working of truckling filter is simple and sheep and does not require any skilled supervision

22.What are the demerits of conventional trickling filters?

1) The loss of head through the filter system is high their making the automatic dosing through siphonic doing tanke necessary

2) The cost of construction of the filter is high
3) They require large area in comparison to their biological treatment processes.

23.What is the necessary of Recirculation in T.F?

Recirculation is necessary to provide uniform hydraulic loading as well as to dilute the high strength waste waters. In constant to the low rate filters, in high rate filters a part of settled or filter efficient is recycled through the filter.

PART-B

1. Explain Ecken folder trickling filter equation. Determine the BOD of the effluent from a loco rate trickling filter that has a diameter of 35 m and a depth of 1.5 m, if the hydraulic loading is 1900 m^3/day and the influent BOD_5 is 150 mg/l. Assume the rate consistant as 1.89 d^{-1} and

□ = 0.67

(Engg services, 1994)

Ecken folder has developed an equation for measuring the performance of twinkling filters, on the basis of rate of waste removal. His final equation which helps to compute the BOD removed by the filter, is given as

Where y_o --> BOD_5 of the influent in terong the filters in mg/l
y_t→ BOD_5 of the efficient getting out of the filter in mg/l
K→ Rate constant /day
D → Depth of filter in m

QL → Hydraulic loading rate per unit area of filter in m3/ day – m^2
=Q/A
The values given in the question are y_t = BOD_5 of the efficient =? y_o = BOD_5 of the influences = 150 mg/l
□ = Depth of filter = 1.5m k = Rate constant per day
= 1.89 d^{-1}

□=0.67
Q_L = Hydraulic loading rate in m^3/d-m^2

$$\square \ 1900 m\ d^3 /$$

$$= Area \text{ of filter}$$

$$=6.027$$

$$y_t \square \frac{150}{6.027} \square 24.89 mg\ l/$$

Say 25 mg/L
Hence the BOD_5 of the filter efficient = 25mg/L

2. Stabilisation ponds for a town of 3000 population are provided to operate in serves. The larger cell has area of 60,000 m^2, and the smaller one 30,000 m^2. The average daily was to flow is 900 m^3/d containing 200 kg of BOD (222 mg/e)

(i) For series operation, calculate the BOD loadings based on both the total pond area and the larger cell only.

(ii) Estimate the number days of winter storage available between 0.6 m and 1.5 m water levels. Assuming an evaporation and seepage loss of 2.5 mm of water per day.

(i) a) BOD Loading based on total pond area Total pond

area of both cells joined in serves

= 60,000 m^2 + 30,000 m^2

= 90,000 m^2 = 9 hec

Total BOD per day = 200 kg/day
BOD loading in kg/ha/day

$$\frac{200}{9} \text{ kg d ha/ /}$$

= 22.2 kg/ha/day

(i) (b) BOD loading based on area of larger cell only
Area of larger cell = 60,000 m^2 = 6 hac BOD = 200 kg/day
BOD loading on kg/ha/day

$$\frac{200}{6}$$

=33.3 log/ha/day

(ii) To calculate the number of days of storage between WL 0.6 m and 1.5 m, we have depth available for storage
= 1.5 – 0.6 = 0.9 m

Total area = 90,000 m^2

Volume of stage available
= 90,000 x 0.9 = 81,000 m^3
Daily in flow of sewage = 900 cum/day
The sewage volume, which percolates and evaporates daily = 2.5 mm depth

$$\frac{2.5}{10} \times \frac{1}{100} m \text{ X surface area of tanks}$$

$$\frac{2.5}{1000} \times 90{,}000$$

= 225 m^3

- Not effective daily in flow of sewage

= (900 – 225) m^3
= 675 m^3/day

- Winter storage available as days

$$= \frac{\text{vol. of storage in } m^3}{\text{Daily net sewage inflow on m / } day}^3$$

$$\frac{81,000}{675} \; days$$

= 120 days.

3. Design the dimension of a septic tank for small colony of 150 persons provided with an assured water supply from the municipal head works at a rate of 120 lit/p/day assume any data, you may Reed. The quantity of water supplied

= per capital rate X population =
120 X 150 lit / day = 18,000 l/d.

Assuming the definition time to be 24 hrs, we have the quantity of sewage produced during the definition period (ie the capacity of the tank)

= 14,400 x 24/24
= 14,400 lit

Now assuming the rate of deposited sludge as 30 lit/capital/year; and also assuming the period of cleaning as 1 year, we have

The volume of sludge deposited = 30 x 150 x 1
= 4,500 lit

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= 4,500

Total required capacity of the tank

= capacity for sewage + capacity for sludge
= 14,400 + 4,500
= 18,900 lit = 18.9 m^3

Assuming 1.5 m as the depth of the tank, we have the surface area of the tank

$$= \frac{18.9}{1.5} \text{ m}^2 = 12.6 \text{ m}^2$$

If the ratio of the length to width is kept as 3:1, we have $3.B^2 = 12.6$

$$B = \sqrt{\frac{12.6}{3}} = \sqrt{4.2} = 2.05 \text{ m say}$$

= 2.10 m

Provide width = 2.1 m & provide length of the tank = 6 m

 Area of C/s provided = 6 X 2%

= 12.6 m^2 (same as required)

Thus, the dimensions of the specific tank will be

6m X 2.1 m X (1.5 + 0.3) m over all depth

(0.3 m used as free board)

Hence the use a tank of size 6m X 2.1 m X 1.8 m

4. Design a septic tank for the following data Number of people = 100
Sewage / capital/day = 100 lit
De – sluding period = 1 year
Length = width = 4 : 1

Quantity of sewage produced per day = 12,000 lit/day

Assuming the defention period to be 24 hrs, we have the quantity of sewage produced during the defention period is the capacity of the tank.

= 12,000 x 24/24

= 12,000 lit

Now assuming the rate of sludge deposit as 30 lit/capita/year and with the given 1 year period of cleaning, we have

The quantity of sludge deposited = 30 x 100 x 1
= 3,000 lit

Total required capacity of the tank = 12,000 + 3,000

= 15,000 lit
= 15 m^3

Assuming the depth of the tank as 1.5 m, the c/s area of the tank

$\frac{15}{1.5} = 10\ m^2$

Using L : B as 4 : 1 (given)

$4\ B^2 = 10$

$B = \sqrt{2.5} = 1.5m$

c = 4 X 1.5 = 6 m

The dimensions of the tank will be 6 m X 1.5 m X (1.5 + 0.3 m) as overall depth with 0.3 m free board. Hence, use a tank of size 6 m X 1.5 m X 1.80 m

6. In previous problem, what would be the size of its soak well if the effluent from the septic tank is to be discharged in it.

Design of soak-well :

The soak-well or seak pit can be designed by assuming the per collation capacity of the filtering media, say as 1250 lit per m^3 per day.

Sewage out flow = 12000 l/d
Per collation rate = 1250 l/m^3/d

Volume (of filtering media) required for the

seak – well $= \frac{12000\ l/d}{1250\ l/m/d} = 9.6 m^3$

If the depth of the seak well is taken as say 2 m, then Area of soakwell required

$= \frac{9.6}{2} = 4.8 m^2$

Dia of soak-well required = $\frac{4.8 \times 4}{11}$

= 2.47 m

7. Estimate the size of a septic tank [C l/w = 2.25) liquid depth 2m with 300 mm free board). Desludging intervals in years, and the total trench area (m^2) of the perlocation field, for a small colony of 300 people. Assume water supply of 100 lit/cap/d, waste water flow of 80% of water

consumption, sludge production of 0.04 m^3/cap/year and the refention time of 3 days at start up. Deluding is done when the tank is one-third full of sludge A per collation test indicated an allowable hydraulic loading of 100 per square metre per day (Gate – 1995)

(i) Size of tank
(ii) Do sludging interval in years
(iii) Total trench area of percolation fields in m^2 Given : L/B = 2.25
Dw = 2 m

Free-board = 0.3 m
Population = 300
Water supply = 100 L/c/day
Waste flow = 80% of water supplied
Sludge production = 0.04 m^3/e/year
Retention time = 3 days
Using the above data, we have
Water supply to the colony=100L/c/dX300 persons
= 30,000 L/d

Sewage produced in 3 days (ie during retention period)
= 3 X 24,000 L/d
= 72,000 L = 72 m^3

De sludging is done when the tank is filled upto 1/3rd of the capacity.

C) Hence, sludge volume collected is c/3
Capacity (c) = Max sewage volume retained
+ Sludge volume retained

C = 72 m^3 + C/3
2/3 C = 72 m^3
C = 72 X 3/2 = 108 m^3

Hence the capacity of the tank = 108 m^3
But C = C X BXD_w = 2.25 B X B X 2 = 108 m^3

$$B^2 \quad \frac{10^8}{4.5} \quad 24$$

B = 4.9 m
C = 2.25 X 4.9 = 11.10 m say

(i) Hence, thus tank size =11.1m X 4.9 m X (2 +0.3m) depth sludge volume removed in de sludging =c/3=36 m^2

Sludge produced per year $= 0.04 \frac{m^3}{capital\ year} \times 300 persons$

= 12 m^3/year

36 m^3 of sludge will there fore be produced in

= 1/12 X 36 year

= 3 years

(ii) Hence, desludging interval = 3 years
Hydraulic loading of perolation trench
= 100 L/m^2/day

out flowing sewage per 3 days = 72 m^3 out flowing sewage per 1 day = 24 m^3 = 24,000 L/d (iii) Trench Area required

$$= \frac{24{,}000 \text{ L/d}}{100 \text{ L/m} / d}$$

$$= 240 \text{ m}^2$$

8. Describe the advantage and Disadvantages of septic tank?

Advantages

1. Septic tanks can be easily constructed and do not require any skilled supervision during construction. More ever, there is no maintenance problem (except periodical cleaning) as there is no moving part in it.
2. Their cost is reasonable compared to the advantages and sanitation they offer on rural or urban areas, where no sewage system has been load.
3. An excellently functioning septic tank can considerably reduce the suspended solids and BOD from sewage.
4. The sludge volume to be disposed of is quite less, as compared to that in a normal Iedomentation tank. The quantity is reduced due to digestion taking place in the tank itself. The reduction in volume is about 60% and reduction in weight is about 30%
5. The effluent from the septic tank can be disposed of an land in a soak-pit or a cost pool, without mach trouble.
6. They are best suited for irolated rural, areas, and for isolated hospitals, buildings etc. Disadvantage

1. If the tank is not properly functioning, which happens many is times then the effluents will be very foul, dark and even worser than the influent.
2. They require too large sizes for serving many people.
3. Leakage of gases from the top cover of septic tank may cause bad smells and environmental pollution.
4. Periodical cleaning, removal and disposal of sludge remains a tedious problem.
5. The working of a septic tank is centre dictable and non-uniform.