53 (CE 717) DWTS

2014

DESIGN OF WATER SUPPLY AND TREATMENT SYSTEM

Paper : CE 717

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. *(a)* The following are the data given of a change in diameter effected in laying a water supply pipeline. The change in diameter is gradual from 20*cm* at *A* to 50*cm* at *B*. Pressure at *A* and *B* are $0 \cdot 8 kg/cm^2$ and $0 \cdot 6 kg/cm^2$ respectively with the end *B* being 3*metres* higher than *A*. If the flow in the pipeline is 200*litre/sec*, find

   (i) Direction of flow

   (ii) the head loss in friction between *A* and *B*. 15

(b) Define the term Optimum Coagulant Dose and explain its significance in water treatment. 5

2. (a) Determine the resultant *pH* of two electrolytic solution one with a *pH* of 6·0 and the other with a *pH* of 8·0. 6

(b) Design a plain sedimentation tank to treat 4 million litres water per day. The detention period may be assumed as 6 *hours* and the depth may be assumed as 3·5*m*. Assume velocity of flow as $10 cm/min$. 6

(c) Design an oxidation pond for treating domestic sewage contributed by 10,000 persons supplied with water at 200*litres* per person per day. The BOD and suspended solids are 300mg/L each. Permissible organic loading for the pond is not less than 500$kg/ha/day$. The detention period is not to exceed 6 days. Assume width to length ratio as 1 : 2 and operational depth as 1·2*m*. Assume any other data not given. Sewage volume may be taken equal to water supplied. 8

3. *(a)* Design a septic tank for a small colony of 300 persons with average daily sewage flow of 85 *litres* per head. Detention period is 30 *hours*, cleaning interval is 6 months. Draw a neat sectional sketch showing all details. 10

(b) Draw the layout of a water treatment plant of a city with river as the source. Label various units. 10

4. *(a)* Design a rapid sand filter unit for a population of 1,00,000 which is to be served by a 200*litres/head/day* water supply.

Assume rate of filtration $= 3 \times 10^5\ m^3/ha/day$.

Amount of wash water required $= 5\%$ filtered water. Dimension of one filter unit $= 17 \cdot 5m \times 10m$. 10

(b) Draw the sketch of a two pipe system of house drainage, showing the appurtenances also. 5

(c) Calculate the discharge of $1 \cdot 25m$ circular sewer laid at a slope of 1 in 360 when it is running half full. Assume n in Mannings formula as 0·011. 5

5. *(a)* Determine the size of a high rate trickling filter. Given :

(i) Sewage flow = $50 mlD$, *(ii)* Recirculation ratio $= 1 \cdot 4$, *(iii)* BOD of raw sewage $= 240 mg/L$, *(iv)* BOD removed in primary tank 351, *(v)* Final BOD of the effluent is less than $30 mg/L$. 15

(b) State the WHO International water quality standard relating to the presence of chloride, total solid, turbidity, hardness nitrates. 5

6. *(a)* Why do you soften the water ? Describe clearly the lime soda process of softening water. 8

(b) Design an imhoff tank to treat the sewage from a small town with 30,000 population. The rate of sewage may be assumed as 150*litre* per head per day. Make suitable assumption whereever needed. 12

7. *(a)* Describe in brief the various methods adopted in final disposal of waste water sludges. 8

(b) Determine the distribution of flow in the pipe network shown in *fig* below. The head loss h_L may be assumed as KQ^n. The flow is turbulent and pipes are rough. The value of K for each pipe is indicated in the figure. Use Hardy-Cross method. 12