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**53 (CE 404) ENEN**

**2019**

# ENVIRONMENTAL ENGINEERING-I

Paper : CE 404

*Full Marks : 100*

Time : Three hours

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

*Answer **any five** questions.*

1. *(a)* What is meant by the term per capita demand ? How is it estimated ? 3

   *(b)* Discuss the logistic curve method for determining the future population of a town. Why is the population forecast necessary in the design of public water supply scheme ? 7

   *(c)* What do you understand by continuous and intermittent system of water supply ? 4

*Contd.*

(d) Derive an expression for determining the discharge from an unconfined aquifer. 6

2. (a) Draw a neat sketch of a rapid gravity filter and describe how it works. What are its advantages over the slow sand filter ? 10

(b) Differentiate between (i) Temporary and Permanent hardness (ii) Break Point Chlorination and Super Chlorination. 10

3. (a) Illustrate with sketches the different types of layouts of pipe systems in distributing water and compare their comparative merits and demerits. 8

(b) Explain in brief the various filter troubles. 7

(c) Design a tubewell for the following data : Yield required = 0.08 *cumecs* thickness of confined aquifer = 30*m*, Radius of circle of influence = 250*m* drawdown = 4*m*, permeabilty coefficient = 60*m*/day. 5



4. (a) Derive Stoke's law for settlement of discrete particles in water. How do you modify the law, taking into account the temperature effect ? 6

(b) For a continuous flow settling tank 3*m* deep and 60*m* long design the flow velocity of water for effective removal of 0.025*mm* particles at 25°*C*. The specific gravity of particle is 2.65 and kinematic viscosity for water may be taken as 0.01 $cm^2/sec$. 4

(c) Primary settling tank of 25*m* in diameter with 3*m* side water depth, for a water flow of 20,000 $m^3/day$ calculate 6

(i) surface area and volume

(ii) detention time in hours and

(iii) overflow rate in $m^3/m^2/day$.

(d) Explain in brief the wet feeding of coagulant. 4

5. (a) Explain from the point of view of water quality criteria, the significance of the following : 3×5=15

(i) Turbidity

(ii) Nitrogen and its compound

(iii) Total solids

(iv) pH value and its determination

(v) taste and odour.

(b) Explain the purpose of aeration in water treatment. What are its limitations ? 5

6. (a) Design rapid sand filtration unit for a population of 100.000 to be served by a 200 litree/capita/day water supply. Assume the following : 15

Rate of filtration = $3 \times 10^5$ $m^3/hr/day$

Amount of wash water = 5% of filtered water/day. Filter dimension of each unit = $17.5m \times 10m$. Assume any other data not given. The filter needs to have washing once is 24 hours.

(b) Explain Zeolite process of softening water in detail. 5

7. (a) The Maximum daily demand at a water purification plant has been estimated as 15 million liters per day. Design the



dimensions of a sedimentation tank for the raw supplies, assuming a detention period of 8 hours and the velocity of flow as 20*cm* per minute. 5

(b) Write a note on provision for fire demand in water supply. 5

(c) The population of the locality as obtained from census report is as follows : 6

| Census year | Population |
|---|---|
| 1911 | 3,50,000 |
| 1921 | 4,66,000 |
| 1931 | 9,94,000 |
| 1941 | 15,60,000 |
| 1951 | 16,23,000 |

estimate the population of the locality in the year 2011 by using incremental method.

(d) Define the following terms : 4

(i) Detention period

(ii) Surface loading.



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