[Total No. of Questions - 9] [Total No. of Printed Pages - 4] (2064)

14707

B. Tech 6th Semester Examination

Water Supply and Treatment

CE-6005

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five questions in all. Select one question from each of the sections A, B, C and D. Section E is compulsory. Attempt all sub parts. Use of non-programmable calculator is allowed.

SECTION - A

1. (a) Estimate the average consumption of water per capita per day for the hilly towns in India. Explain daily variation in consumption of water. (10)

   (b) A community has a population of 75,000 in the year 2011, and is expected to reach 110,000 in the year 2021. The average water demand in 2011 was 150 lpcd. It is expected that the water consumption rate will be reduced to 135 lpcd by the year 2021. Assuming that the population increase and decrease in consumption have a linear relationship, calculate the year when the treatment plant will reach an average treatment capacity of 20 MLD. (10)

2. (a) Explain clearly the conditions under which groundwater is available in nature. Why groundwater is preferred to surface water for domestic water supply? (10)

   (b) Design an open well in fine sand to give a discharge of 0.005 cumecs when worked under a depression head of 3.0 meters. Take the value of the specific yield for fine sand as 0.5 m^3 per hour per square meter of area, under unit depression head. (10)

SECTION - B

3. (a) Explain water quality in terms of specific parameters such as the concentration of Ca^{+2}, Mg^{+2}, SO_4^{-2}, Cl^- or of gross parameters such as suspended solids, alkalinity, hardness, and BOD. (10)

   (b) Describe how samples of water should be collected and sent to the laboratory for the chemical examination, indicating necessary precautions to be observed. (10)

4. (a) Elaborate the MPN test for bacteriological analysis of surface water. State the bacteriological standards for potable water. (10)

   (b) Using the Poisson distribution, determine the MPN/100 mL for a water sample from which 10, 1, and 0.1 mL/100 mL dilutions resulted in four, three, and five positive-lactose-formation tubes, respectively. (10)

SECTION - C

5. (a) Explain with the help of flow diagrams, various operations/ processes employed in conventional water treatment. (10)

   (b) Design a rectangular sedimentation tank to remove spherical particles of size $\geq$ 50μm with a specific gravity of 2.3 from 100 MLD of turbid water. Also determine the detention time of tank. Assume (i) Stoke's law of sedimentation is applicable, (ii) length to width ratio is 3:1 for the tank, (iii) depth of tank is 3 m. (iv) kinetic viscosity of water is 1.01×10^{-6} m^2/s. (10)

6. (a) Describe the purposes of (i) flocculation. (ii) softening, and (iii) disinfection in water treatment. (10)

   (b) A city has to treat 24 MLD of turbid water using rapid sand filters with a filtration rate of $5m^3/h/m^2$. Determine the size of filter bed if L:B = 2:1. In addition determine the percentage of filtered water that is required to backwash the filter, if the rate of backwash is six times the rate of filtration and the duration of backwash is 10 minutes. Backwashing is done once a day. (10)

SECTION - D

7. (a) Describe the necessity of having a planned piped water supply scheme for a town. How are such schemes executed? (10)

   (b) From a clear water reservoir 2.50 m deep and maximum water level at 32 m; water is to be pumped to an elevated reservoir at 80 m; at a constant rate of 8,10,000 litres per hour. The distance is 1,200 m. Determine the economical diameter of the rising main and the water horse power of the pump. Neglect minor losses and take f = 0.04. (10)

8. (a) Detail the major components of a house water service connection. Describe the minimum and maximum pressures for residential service connections. (10)

   (b) A pump is to deliver water from an underground tank against a static head of 30m. The suction pipe is 40 m long and is of 300 mm diameter with Darcy-Weisbach friction factor f = 0.02. The delivery pipe is of 250 mm diameter, 1500 m long and has f = 0.022. The pump characteristics can be expressed as: $H_p = 100 - 6000\ Q^2$, H_p - pump head in m and Q - discharge in m^3/s. Calculate the head and the discharge of the pump. (10)

SECTION - E

9. (a) Fill in the blank with single correct option:

   (i) The suitable method for forecasting population for an old developed large city is _____ (zoning/ arithmetic mean/geometric mean/ comparative graphic).

   (ii) Water losses in water supply system are assumed as _____ (5%/ 7.5%/ 15%/ 25%).

   (iii) The devices which are installed for drawing water from different water sources are called _____ (filters/ intakes/ outlets/ inlets).

(iv) The formula which is most appropriate to the design of pressure pipes is _____ (Darcy Weisbach/ Manning's/ Chezy's/ Dupuit's).

(v) The product of H ions and OH ions in a stronger acid is _____ (0/ 1/ 10^{-7}/ 10^{-14}).

(vi) The valve which allows the flow in one direction is a _____ (reflux valve/sluice valve/ gate valve/ butterfly valve).

(vii) The yield of a rapid gravity filter as compared to that of slow sand filter is _____ (15 times/20 times/30 times/ 35 times).

(viii) E.Coli bacteria die in water having pH greater than _____ (8.5/ 9.5/ 10.5/ 11.5).

(ix) Mostly used coagulant is _____ (chloride/ alum/ lime/ bleaching powder).

(x) Distribution main of any water supply is normally designed for its average daily requirement _____ (100%/ 150%/ 200%/ 225%).

(1×10=10)

(b) Match the following statements (put the number from column Q into the column P)

Column - P	**Column - Q**
(i) River	(i) Cast iron
(ii) Sedimentation tank	(ii) Mohr's method
(iii) Dissolved solids	(iii) Silt
(iv) Chloride	(iv) Closed impeller
(v) Excess of lead	(v) Zonal distribution
(vi) Water mains	(vi) Disinfection
(vii) Radial system	(vii) Overflow rate
(viii) Centrifugal pump	(viii) Anemia
(ix) Turbidity	(ix) Surface source
(x) Tubewell water	(x) Reverse osmosis

(1×10=10)