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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Fifth Semester, B.E. - Civil Engineering

Semester End Examination; Dec - 2016/Jan - 2017

Water Supply Engineering

Time: 3 hrs

Max. Marks: 100

Note: Answer FIVE full questions, selecting ONE full question from each unit.

UNIT - I

- 1 a. Explain the importance and need for a planned water supply scheme of a town. 4
 b. What is per capita demand and explain the various factors that affect the per capita demand. 8
 c. The following population data are available for a town. Estimate the population of the town in the year 2022 using incremental increase method and arithmetical increase method. 8

Year	1952	1962	1972	1982	1992	2002	2012
Population	12000	16500	26800	41500	57500	68000	74100

- 2 a. What is design period? Discuss the factors affecting design period of water supply scheme. 6
 b. Define intake structures. What are the factors which govern selection and location of intake structure? 6
 c. Water has to be supplied to a town with one lakh population at the rate of 150 litres per capita day from a river 2 km away. The difference in elevation between the lowest water level in the sump and the reservoir is 36 m. If the demand has to be supplied in 8 hours, determine the size of the main and BHP of the pumps required. Assume maximum demand as 1.5 times the average demand. Assume $f = 0.0075$, velocity in the pipe 2.4 m/s and efficiency of pump as 80%. 8

UNIT - II

- 3 a. What are the common impurities found in natural sources of water and explain their effects upon its quality? 6
 b. With a typical flow chart, explain the water treatment units for treating river water indicating the impurities removed at each unit. 6
 c. Mention the permissible limits for the following parameters and explain the environmental significance of each: Nitrates, Iron, Fluorides and Sulphates. 8
 4 a. What are water borne diseases? List the water borne diseases with causative agents. 8
 b. Differentiate between palatable water and potable water. 6
 c. What do you understand by E-coli? How do you determine its presence in water? 6

UNIT - III

- 5 a. Define aeration process. Briefly discuss any two methods of aeration employed in water treatment works. 6

- b. Define overflow rate and detention period for plain sedimentation tank. 6
- c. A circular sedimentation tank fitted with standard mechanical sludge removal equipment is to handle 3.5 million liters per day of water. If the detention period of the tank is 5 hours, and the depth of the tank is 3 m, what should be the diameter of the tank? 8
- 6 a. What do you understand by plain sedimentation? Describe the design concepts in an up flow clarifier for Type-I setting. 6
- b. Why alum is commonly used coagulant? Write down the reactions. 6
- c. Determine the quantity of filter alum and quick lime having 85% purity to treat 40 MLD of water. The dosage of alum is 18 mg/l and the natural alkalinity is 5 mg/l as CaCO₃. (Molecular weight of alum = 666, Ca = 40, C = 12, H = 1 and O = 16). 8

UNIT - IV

- 7 a. Explain the mechanism of filtration. 6
- b. Explain with a neat sketch the working and cleaning of a rapid sand filter. 6
- c. Design two rapid sand filter beds from the following data:
 Population to be served = 50000 per capita demand = 180 lpcd,
 Rate of filtration = 5000 litres/hr/sqm. 8
 Length of each bed = 1.5 times the width
 Max demand per day = 1.8 times the average daily demand.
- 8 a. What do you understand by chlorination? Explain the disinfection action of chlorine with chemical reactions. 6
- b. Chlorine usage in the treatment of 20000 m³/day is 8 kg/day. The residual chlorine after 10 min contact is 0.20 mg/l. Calculate the dosage in milligrams/litre and chlorine demand of the water. 6
- c. Explain break point chlorination and super chlorination. 8

UNIT - V

- 9 a. What is softening of water? Discuss the lime soda process of softening with chemical equations involved in the process. 8
- b. What are the advantages and disadvantages of zeolite process? 6
- c. What do you understand by defluoridation of water? Describe Nalgonda technique of defluoridation of water. 6
- 10 a. What are the functions of distribution reservoirs? 6
- b. List the various layouts of water distribution network. Explain any two methods. 6
- c. Explain with sketches sluice valve and air valve. Indicate their locations in water transmission and distribution system. 8