

Code No: RT32011

**R13**

SET - 1

**III B. Tech II Semester Regular/Supplementary Examinations, April- 2017**  
**ENVIRONMENTAL ENGINEERING – I**  
(Civil Engineering)

Time: 3 hours

Max. Marks: 70

- Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)  
2. Answering the question in **Part-A** is compulsory  
3. Answer any **THREE** Questions from **Part-B**  
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**PART –A**

- 1 a) Write a short note on various methods of estimating fire demand. [3M]
- b) Compare ground water sources and surface water sources with reference to their quality and quantity. [4M]
- c) Give the desirable limits and permissible limits in the absence of other source for the following water quality parameters as per IS 10500 1991: [4M]  
i) Turbidity ii) Fluorides iii) Nitrates and iv) Sulphates
- d) Draw flow chart of water treatment plant for highly turbid river water. [3M]
- e) Explain with relevant equations, how chlorine acts as a disinfectant? [4M]
- f) What are the requirements of good water meters? [4M]

**PART –B**

- 2 a) What is meant by design period of a water supply scheme? Discuss various factors affecting design period. [6M]
- b) Predict the population for the year 2021 and 2031 using the following data by geometrical increase method and incremental increase method. [10M]

Census Year	Population
1951	21,000
1961	22,800
1971	30,000
1981	42,000
1991	50,000
2001	55,500

- 3 a) Explain the stepwise procedure to determine the reservoir capacity using mass curve technique. [8M]
- b) Explain canal intake with neat diagram. Mention important design features. [8M]
- 4 a) Explain EDTA method for the determination total, permanent and temporary hardness of water. Give the relevant chemical equations. [6M]
- b) Explain how do you conduct the following tests to detect the presence of coliform group: [10M]  
i) Presumptive test ii) Confirmed test iii) Completed test
- 5 a) Explain with relevant chemical equations, how alum acts as coagulant. What are the advantage and disadvantages of alum? [8M]
- b) Design slow sand filter beds for 50,000 population with an average per capita supply of 200 lpcd. Assume relevant data required. Keep one unit as stand by. [8M]

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- 6 a) Explain with relevant chemical equations, Lime-Soda process for softening of hard water. What are the advantages and disadvantages of this process? [10M]  
b) Describe the following methods of disinfection and mention their advantages and disadvantages: [6M]  
i) Ozonation ii) UV-radiation
- 7 a) Explain stepwise procedure for the analysis of complex water distribution networks using Hardy-cross method. Derive expression for correction term. [10M]  
b) Write short notes on: i) Sluice valve and ii) Check valve [6M]

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**PART –A**

- 1 a) Briefly discuss any four factors affecting design period of a water supply scheme. [4M]
- b) Define gravity conduits and pressure conduits. What are the advantages of pressure conduits over gravity conduits? [3M]
- c) The measured pH values of incoming and outgoing waters at a water treatment plant are 7.5 and 8.8 respectively. Determine the average pH of water, assuming linear variation of pH with time. [4M]
- d) Explain the principle of coagulation. [3M]
- e) What are the purposes served by aeration? List any four methods of aeration. [4M]
- f) Explain any one type of fire hydrant with a neat diagram. [4M]

**PART –B**

- 2 a) Explain various factors that affect per capita water consumption of a city. [8M]
- b) Estimate the probable population of a city for the years 2021 and 2031 by Arithmetic Increase method from the following censuses data. [8M]

Census Year	Population
1951	35,000
1961	42,700
1971	48,800
1981	60,000
1991	72,800
2001	88,500

- 3 a) Draw a neat diagram of a river intake structure. Explain the salient features. [8M]
- b) The yield of water from a catchment area during each successive month is given below. Determine the minimum capacity of a reservoir required to allow the above volume of water to be drawn off at a uniform rate assuming that there is no loss of water over the spillway. [8M]

Month	Inflow (M.cu.m)	Month	Inflow (M.cu.m)
January	1.5	July	8.4
February	2.2	August	5.6
March	3.0	September	2.3
April	8.9	October	2.0
May	12.0	November	1.8
June	11.8	December	1.2

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- 4 a) Explain in detailed the procedure for determination of MPN index of a water sample. [10M]  
b) What are the sources and effects of the following water quality parameters? [6M]  
i) Turbidity ii) Fluorides and iii) Hardness
- 5 a) 4 MLD of water per day passes through a sedimentation tank basin which is 6 m wide, 16 m long and 3.5 m deep. (i) Find the detention time for this basin (ii) Determine the average velocity of flow through the basin (iii) Compute the SOR of the basin. [8M]  
b) Distinguish between slow sand filters and rapid gravity filters. [8M]
- 6 a) Explain Zeolite process for water softening. Enumerate its advantages and disadvantages. [10M]  
b) Explain various methods of defluoridation. [6M]
- 7 a) Describe with neat diagrams various layouts of distribution. Mention the applicability of each method. [8M]  
b) What are the requirements of a good water meter. Explain any one type of water meter with a neat sketch. [8M]

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**PART – A**

- 1 a) Discuss the role of environmental engineer in protecting public health and improving quality of life of the society. [4M]  
b) What are tube wells and bore wells? Compare the quality and quantity of water obtained from these sources. [3M]  
c) Give the desirable limits for the physical parameters of drinking water as per IS 10500 -1991. [4M]  
d) What are the advantages and disadvantages of using alum as coagulant? [3M]  
e) With a neat diagram explain break point chlorination curve. [4M]  
f) What are gravity system and combined gravity and pumping system of water distribution? What are the advantages of combined system? [4M]

**PART – B**

- 2 a) Draw the flow chart of public water supply scheme. [4M]  
b) The population of the past three successive decades of a city is given below. Estimate the population of the city for the year 2021 by decreasing rate of growth method. [8M]

Census year	Population
1981	47050
1991	54500
2001	61000

- c) Write a short note on variations in rate of demand of water. [4M]
- 3 a) Explain various factors governing the selection of a suitable site for the location of an intake structure. [8M]  
b) A pipe line 0.8 m diameter is 1.5 km long. To augment the discharge, another pipe line of same diameter is introduced in parallel to the first in the second half of its length. Find the increase in discharge. The difference of head between inlet and outlet of the pipe line is 35 m. Use Darcy-Weisbach formula with  $f = 0.04$ . [8M]
- 4 a) Explain the following methods for ascertaining bacteriological quality of water. [8M]  
i) Total count test and ii) Membrane filter technique. What are the advantages of membrane filter technique?  
b) What are the disadvantages of excess hard water when supplied for industrial purpose? [4M]  
c) Find out the pH of a mixture formed by mixing the following two solutions: [4M]  
Solution A: Volume = 300 ml and pH = 7  
Solution B: Volume = 700 ml and pH = 6

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- 5 a) Define optimum dosage of coagulant. Explain jar test for the determination of optimum dosage of coagulant. [8M]  
b) Draw a neat diagram of rapid sand filter and explain how the backwashing operation is carried out. [8M]
- 6 a) Calculate the quantity of bleaching powder required per year for disinfecting 6 million litres of water per day. The dose of chlorine has to be 0.35 ppm and the bleaching powder contains 35% of available chlorine. [5M]  
b) Explain the following: [8M]  
i) Removal of colour, odour and taste by Activated carbon  
ii) Removal of iron and manganese  
c) What do you understand by the term residual chlorine? Explain its significance in water supply scheme? [3M]
- 7 a) Describe with neat diagrams various layouts of distribution. Mention the applicability of each method. [8M]  
b) Write short notes on: [8M]  
i) Requirements of a good distribution system  
ii) Equivalent pipe method

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**PART –A**

- 1 a) Write a short note on waterborne diseases caused by bacteria and inorganic matter. [4M]
- b) Draw a neat diagram of canal intake. [4M]
- c) Write down the permissible limits for the following parameters as per IS 10500-1991 for drinking water: [4M]  
i) Chlorides ii) Total Dissolved Solids iii) pH and iv) Phenolic compounds
- d) Define Surface Over Flow rate and Detention period for a continuous flow sedimentation tank. Give the range of values normally adopted in the design for the above two parameters. [3M]
- e) What do you understand by Chlorine Demand and Free Residual Chlorine? What is the importance of residual chlorine [4M]
- f) Write a short note on pressure in distribution layouts. [3M]

**PART –B**

- 2 a) For a city of 1,00,000 population and an average water supply of 200 lpcd, calculate fire demand by using various equations and IS code provisions. Also determine the coincident draft. [7M]
- b) What is meant by per capita demand and design period? Discuss various factors which affect per capita consumption of water. [9M]
- 3 a) Explain various surface and sub-surface water sources with reference to available quantity and quality of water. [8M]
- b) Explain stepwise procedure to determine the capacity of storage reservoir by using mass curve method. [8M]
- 4 a) Explain the following tests used for the bacteriological analysis of the given water sample: [10M]  
i) Presumptive test ii) Confirmed test and iii) Completed test
- b) The analysis of water from a well showed the following results in mg/L:  
 $\text{Ca}^{++} = 65$ ,  $\text{Mg}^{++} = 51$ ,  $\text{Na}^+ = 101.5$ ,  $\text{K}^+ = 21.5$  [6M]  
 $\text{HCO}_3^- = 248$ ,  $\text{SO}_4^{--} = 221.8$ ,  $\text{Cl}^- = 79.2$   
Find the total hardness, carbonate hardness and non-carbonate hardness.

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- 5 a) Derive an expression for the determination of settling velocity of discrete particles. [8M]  
b) Design rapid sand filters beds for treating water required for a population of 1,50,000 people with an average rate of demand of 150 lpcd with the following data: [8M]  
i) Filter area of each unit should not be more than 50 m<sup>2</sup>  
ii) Amount of water used for back-washing is 4% of treated water per day  
iii) The time required for back washing may be neglected  
iv) One unit must be kept as stand by.  
Assume any other data required.
- 6 a) Explain zeolite method for water softening. Mention the advantages and drawbacks of this method. [8M]  
b) Write short notes on: [8M]  
i) Nalgonda Technique for defluoridation  
ii) Break point chlorination  
iii) Aeration
- 7 a) Explain stepwise procedure for the analysis of complex water distribution networks by using Hardy-cross method. Derive expression for correction term. [10M]  
b) Write short notes on: i) Air relief valve ii) reflex valve and iii) scour valve [6M]

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