SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF CIVIL ENGINEERING

QUESTION BANK

VI SEMESTER

CE3663- WATER SUPPLY AND WASTEWATER ENGINEERING

Regulation – 2023

Academic Year 2025-2026

Prepared by

Dr.D.ELANGO, Professor & Head

Department of Civil Engineering

SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF CIVIL ENGINEERING

QUESTION BANK
(As per Autonomous 2023 Regulation)

SUBJECT CODE/NAME: CE3663 WATER SUPPLY AND WASTE WATER ENGINEERING
SEM/YEAR: VI/III

UNIT I - WATER SUPPLY SYSTEM - SOURCE AND CONVEYANCE

Objectives- Population forecasting- Design period- Water demand – Characteristics Sources of water – Selection of water source-Water quality parameters & significance - standards-Intake structures -Conveyance- Laying, jointing & testing of pipes- pump selection - System of water supply-Distribution – rain water harvesting.

PART A

Q.NO	QUESTIONS	BT LEVEL	COMPETENCE
1.	What are the objectives of public water supply system?	BT-1	Remembering
2.	Define Design period.	BT-1	Remembering
3.	What is per capita demand?	BT-1	Remembering
4.	What are the population forecasting methods?	BT-1	Remembering
5.	Define intake of structures.	BT-1	Remembering
6.	Enlist the functions of intake structures.	BT-1	Remembering
7.	The drinking water standards of Residual Chlorine …….. and Hardness……	BT-2	Understanding
8.	How will you save rain water at household level?	BT-2	Understanding
9.	What are the different types of surface water sources?	BT-2	Understanding
10.	List down the physical characteristics of water.	BT-2	Understanding
11.	Explain the points to be observed in selecting a pump.	BT-2	Applying
12.	List down the chemical characteristics of water.	BT-1	Remembering
13.	List out the factors affecting per capita demand.	BT-1	Remembering
14.	What is the main reason for seasonal variations in water demand?	BT-1	Remembering
15.	What is water demand?	BT-2	Understanding
16.	Write down the methods to calculate fire demand.	BT-2	Understanding

<table>
<tr><td>17.</td><td>What are the components of water supply system?</td><td>BT-1</td><td>Applying</td></tr>
<tr><td>18.</td><td>Determine the fire demand for a city with a population of 3500 using freeman’s formula.</td><td>BT-2</td><td>Applying</td></tr>
<tr><td>19.</td><td>What is the principle of centrifugal pump?</td><td>BT-2</td><td>Applying</td></tr>
<tr><td>20.</td><td>What are the external forces acting on water transmission main if the pipe is laid under heavy traffic?</td><td>BT-1</td><td>Remembering</td></tr>
<tr><td>21.</td><td>Summarize the situation in which pumps will be connected
(i) Series
(ii) Parallel.</td><td>BT-1</td><td>Remembering</td></tr>
<tr><td>22.</td><td>What is the principle of reciprocating pump?</td><td>BT-1</td><td>Remembering</td></tr>
<tr><td>23.</td><td>What are the requirements of a good distribution systems?</td><td>BT-1</td><td>Remembering</td></tr>
<tr><td>24.</td><td>Why Rain Water Harvesting is needed?</td><td>BT-3</td><td>Applying</td></tr>
<tr><td>25.</td><td>What do you understand by continues and intermediate supply of water?</td><td>BT-1</td><td>Remembering</td></tr>
<tr><td colspan="4">PART B</td></tr>
<tr><td>1.</td><td>Explain the sources of water in detail.</td><td>BT-3</td><td>Applying</td></tr>
<tr><td>2.</td><td>Explain the classification of wells.</td><td>BT-4</td><td>Remembering</td></tr>
<tr><td>3.</td><td>(i) What are factors governing Design period?
(ii) Explain the factors affecting per capita demand.</td><td>BT-4</td><td>Understanding</td></tr>
<tr><td>4.</td><td>Describe in brief various types of water distribution system.</td><td>BT-3</td><td>Remembering</td></tr>
<tr><td>5.</td><td>Explain the characteristics of water.</td><td>BT-3</td><td>Understanding</td></tr>
<tr><td>6.</td><td>(i) List out the important considerations which govern the selection of site of an intake structure? (6)
(ii) Describe the salient features of river intake with the aid of a neat sketch. (7)</td><td>BT-3</td><td>Applying</td></tr>
<tr><td>7.</td><td>(i) How are the leaks in the distribution systems detected? (5)
(ii) What are the confined and unconfined aquifer? Explain with neat sketch. (8)</td><td>BT-3</td><td>Applying</td></tr>
<tr><td>8.</td><td>The population of 5 decades from 1930 to 1970 are given below.
<table>
<tr><td>Year</td><td>1930</td><td>1940</td><td>1950</td><td>1960</td><td>1970</td></tr>
<tr><td>Population</td><td>25000</td><td>28000</td><td>34000</td><td>42000</td><td>47000</td></tr>
</table>
Find out the population after one, two and three decades beyond the last known decade by using arithmetic increase demand.</td><td>BT-4</td><td>Remembering</td></tr>
<tr><td>9.</td><td>Classify the types of intakes. Also explain the working of a reservoir intake with a neat sketch.</td><td>BT-3</td><td>Understanding</td></tr>
<tr><td>10.</td><td>Determine quantity of water demand in the year 2011 by geometric increase method.
<table>
<tr><td>Year</td><td>1951</td><td>1961</td><td>1971</td><td>1981</td><td>2011</td></tr>
<tr><td>Population in 1000s</td><td>93</td><td>111</td><td>132</td><td>161</td><td>?</td></tr>
</table></td><td>BT-3</td><td>Understanding</td></tr>
<tr><td>11.</td><td>Explain the different types of pumps used in water supplies with a neat sketch.</td><td>BT-4</td><td>Understanding</td></tr>
<tr><td>12.</td><td>i. Prepare the key features of testing and laying of pipeline. (8)
ii.Explain the principle operation of a centrifugal pump with neat sketch. (5)</td><td>BT-4</td><td>Understanding</td></tr>
<tr><td>13.</td><td>Explain the various types of water demand of a water supply scheme.</td><td>BT-3</td><td>Remembering</td></tr>
</table>

<table>
<tr><td>14.</td><td>Compute the population of the year 2000 and 2006 for a city whose population in the year 1930 was 25,000 and in the year 1970 was 47,000. Make use of geometric increase method.</td><td>BT-3</td><td>Applying</td></tr>
<tr><td>15.</td><td>The population of a locality is given below
<table><tr><th>Year</th><th>Population</th></tr><tr><td>1880</td><td>8000</td></tr><tr><td>1890</td><td>12000</td></tr><tr><td>1900</td><td>17000</td></tr><tr><td>1910</td><td>22500</td></tr><tr><td>1920</td><td>29000</td></tr><tr><td>1930</td><td>37500</td></tr><tr><td>1940</td><td>47000</td></tr><tr><td>1950</td><td>57000</td></tr><tr><td>1960</td><td>66500</td></tr></table>Estimate the population of the locality in 1980 by incremental method and determine the water demand.</td><td>BT-3</td><td>Remembering</td></tr>
<tr><td>16.</td><td>From a clear water reservoir 3 m deep and maximum water level at 30 m, water is to be pumped at an elevated reservoir at 75 m at the constant rate of 9,00,000 litres per hour. The distance is 1500 m. Give the economical diameter of the rising main and the water horse power of the pump. Neglect minor losses and take f=0.01.</td><td>BT-3</td><td>Remembering</td></tr>
<tr><td>17.</td><td>Explain Rain Water Harvesting in various methods with suitable sketch.</td><td>BT 4</td><td>Applying</td></tr>
<tr><td colspan="4">PART C</td></tr>
<tr><td>1.</td><td>Mention the points which should be taken into consideration in deciding the location of an intake for the water supply of a large town, the source being a perennial river. Draw a neat sketch of a canal intake and explain the salient features.</td><td>BT-3</td><td>Applying</td></tr>
<tr><td>2.</td><td>Enumerate and explain the characteristics of surface water and ground water. And state their environmental significance.</td><td>BT-4</td><td>Remembering</td></tr>
<tr><td>3.</td><td>Give a detailed account on the selection of pumps and pipe materials suitable for the conveyance system.</td><td>BT-3</td><td>Understanding</td></tr>
<tr><td>4.</td><td>In a water supply scheme to be designed for serving a population of 4 lakhs, the storage reservoir is situated at 8 km away from the city and the loss of head from the source to city is 16 m. Calculate the size of supply main by using Weisbach formula as well as Hazen’s formula assuming a maximum daily demand of 180 liters per day per person and half of the daily supply to be pumped in 8 hours. Assume coefficient of friction for the pipe material as 0.012 in Weisbach formula and C_H =130 in Hazen’s formula.</td><td>BT-3</td><td>Applying</td></tr>
<tr><td>5.</td><td>Enlist the various layout of distribution systems & explain with neat sketch.</td><td>BT-4</td><td>Remembering</td></tr>
<tr><td colspan="4">UNIT II - <u>DESIGN PRINCIPLES OF WATER TREATMENT</u></td></tr>
<tr><td colspan="4">Objectives-Selection of unit operations and process-Principles of screening, flocculation, sedimentation, filtration, disinfection, Softening- demineralization -Aeration Iron removal Defluoridation - Construction, Operation and maintenance aspects.</td></tr>
<tr><td colspan="4">PART A</td></tr>
<tr><td>Q.NO</td><td>QUESTIONS</td><td>BT LEVEL</td><td>COMPETENCE</td></tr>
</table>

1.	Define: Detention time and surface overflow rate.	BT 1	Remembering
2.	List out the advantages of rapid sand filter.	BT 1	Remembering
3.	Mention the advantages of chlorine, as disinfectant.	BT 1	Remembering
4.	Enlist various types of settling.	BT 1	Remembering
5.	Differentiate between unit operation and unit process.	BT 1	Remembering
6.	Discuss the significances of velocity gradient in flocculator design.	BT 1	Remembering
7.	Differentiate between sterilization and disinfection.	BT 2	Understanding
8.	Illustrate the mechanism of disinfection process.	BT 2	Understanding
9.	Discover the factors which depends the dose of coagulants.	BT 2	Understanding
10.	Show the layout plan of water treatment plant.	BT 2	Understanding
11.	Write the objectives of Screen chamber.	BT 2	Applying
12.	Explain the factors influencing settling of discrete particles.	BT 2	Applying
13.	The permissible range of fluoride in a drinking water is ……. and Dissolved oxygen is ……..	BT 1	Applying
14.	Classify filter into different categories.	BT 2	Understanding
15.	Explain the term coagulation.	BT 1	Applying
16.	Rewrite stokes equation for finding settling velocity of particles.	BT 2	Understanding
17.	Write the nature of any four coagulants.	BT 1	Applying
18.	Define reverse osmosis.	BT 1	Applying
19.	Differentiate between demineralization and desalination.	BT 2	Understanding
20.	Describe about the term water softening.	BT 1	Applying
21.	Define Defluoridation.	BT 2	Understanding
22.	How to increase oxygen in the water?	BT 2	Applying
23.	Why maintenance is required in the water treatment plant?	BT 2	Understanding
24.	Summarize the methods of deflouridation.	BT 2	Understanding
25.	List the methods of removing temporary hardness	BT 1	Remembering
	PART B		
1.	(i) Design a rectangular sedimentation tank for 5 MLD flow. (7) (ii) Draw and label the parts of the rectangular sedimentation tank (Longitudinal section) indicating the various zones. (6)	BT 4	Analyzing
2.	Explain about slow sand filter and rapid sand filter with suitable Diagram.	BT 3	Applying
3.	Design six slow sand filter beds from the following data. Population to be served – 50000 Per capita demand – 150 LPCD Rate of filtration – 180 liters/hour/m^2 Length of each bed = Twice the breadth Assume maximum demand as 1.8 times the average daily demand. Also assume that 1 unit out of 6 will be kept as standby	BT 3	Applying
4.	Discuss the design aspects of sedimentation tanks in detail.	BT 4	Analyzing

5.	The maximum daily demand at a water purification plant has been estimated as 12 MLD. Design the dimensions of a suitable sedimentation tank for the raw supplies assuming a detention period of 6 hours and the velocity of flow as 20 cm/min.	BT 3	Applying
6.	i. Chlorine usage in a treatment of 20000 m^3/day is 8kg/day. The residual after 10 minutes contact is 0.2 mg/liter. Calculate the dosage in mg/liter and chlorine demand of the water (7) ii. Illustrate the various unit operations and unit processes involved in water treatment. (6)	BT 3	Applying
7.	i. A circular sedimentation tank fitted with standard mechanical sludge removal equipment is to handle 3.5 million litres per day of raw 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) ii. Find the settling velocity of a discrete particle in water under conditions when Reynold's number is less than 0.5. The diameter and specific gravity of the particle is 5 x 10^{-3} cm and 2.65 respectively. Water temperature is 20^{o}C and kinematic viscosity of water is 1.01 x 10^{-2} cm^2/s (5)	BT 4	Analyzing
8.	Explain the various methods of removing excess Iron and Manganese from Ground water.	BT 4	Analyzing
9.	Elaborate, how are DE fluoridation and demineralization carried out in the advanced water treatment process.	BT 4	Analyzing
10.	Enlist various disinfection process and explain any two methods.	BT 3	Applying
11.	i. Describe the types of hardness present in water. (5) ii. Discuss about the Ion exchange method of water softening with a sketch. (8)	BT 3	Applying
12.	Design of a Rapid sand filter for the population of 1,00,000 and assume other suitable data.	BT 3	Applying
13.	Explain the Zeolite process for the removal of permanent hardness from water.	BT 4	Analyzing
14.	Explain the methods of removing temporary and permanent hardness from water.	BT 3	Evaluating
15.	(i)Explain the Backwashing of filter. (5) (ii) Briefly explain the Nalgonda technique. (8)	BT 3	Applying
16.	(i) What do you understand by super chlorination? What are the various methods of dechlorination. (ii) The water required for a Town of population 25,000. If the disinfection is to be done by the bleaching powder having 45% avaible chlorine. Determine the quantity of the 1% bleaching powder required per year.	BT 4	Analyzing
17.	(i) What are the purposes of Aeration of water? How this is achieved? (6) (ii) What are the different types of aerators? Describe with sketch in detail the working of the aerator used in public water supply schemes. (7)	BT 4	Analyzing
PART C			
1.	(i)Explain briefly on Breakpoint chlorination. (9) (ii)Discuss the role of sedimentation tank in water treatment. (6)	BT 5	Evaluating

2.	Show the mechanism of sand filtration. Draw a neat sketch of filter units and explain its working principle.	BT 4	Analyzing
3.	Write a note on Iron removal from water for small communities.	BT 4	Analyzing
4.	Explain the different methods of Water Softening.	BT 5	Evaluating
5.	What is disinfection? Identify the factors affecting disinfection. Examine the conventional and modern methods which are used to disinfect water.	BT 5	Evaluating

UNIT III - SEWERAGE SYSTEM: COLLECTION AND TRANSMISSION

Sources of wastewater- Quantity of sanitary sewage-storm water runoff estimation wastewater characteristics and significance - design of sewers - laying, jointing and testing of sewers-sewer appurtenances-pump selection – Grey water harvesting

PART A

Q.NO	QUESTIONS	BT 1	Remembering
1.	Define Time of Concentration.	BT 1	Remembering
2.	Define sewage and sewerage.	BT 1	Remembering
3.	Name the sewage characteristics with which organic matter concentration is expressed.	BT 1	Remembering
4.	Show the BOD demand curve.	BT 1	Remembering
5.	Examine the necessity of legal requirements and effluents disposal of sewage.	BT 1	Remembering
6.	Identify the significance of BOD/COD ratio.	BT 2	Understanding
7.	Differentiate between dry weather flow and wet weather flow.	BT 2	Understanding
8.	Discuss the various sources of waste water.	BT 2	Understanding
9.	Discuss how do you estimate storm run-off?	BT 2	Understanding
10.	List out the sources of domestic sewage.	BT 2	Applying
11.	What is the use of manhole in sewerage system?	BT 2	Applying
12.	List out the various sewer appurtenances.	BT 2	Applying
13.	Distinguish between Self Cleaning velocity and Non-scouring velocity.	BT 1	Remembering
14.	Enlist the various methods estimating storm run-off.	BT 1	Applying
15.	State the advantages of egg-shaped sewer sections.	BT 1	Applying
16.	The 5 day BOD of sewage is 240 mg/l. Determine the BOD load in Kg/d for 100 cu.m/day of sewage?	BT 2	Applying
17.	Explain the pollution control board norms for effluent discharge into streams.	BT 1	Applying
18.	What do you mean by intensity of rainfall? How is it determine?	BT 1	Remembering
19.	What is trap? State its quality requirements.	BT 2	Applying
20.	What is combined system of sewerage?	BT 1	Remembering
21.	What are the advantages of using a circular section for sewers?	BT 2	Understanding
22.	Differentiate between unit operations and unit processes in wastewater treatment. Give at least two examples in each.	BT 2	Understanding
23.	What is meant by grey water?	BT 2	Understanding
24.	List out the types of sewerage system.	BT 2	Understanding
25.	Explain the requirements of the good sewer joints.	BT 1	Remembering

PART B			
1.	i).List out the characteristics and composition of sewage and state their environmental significance. (6) ii).BOD of a sewage incubated for 2 days at 30^{o}c was found to be 160 mg/l. Find the value of 5 day 20^{o}c BOD. Assume k (base 10) at 20^{o}c as 0.12 per day. (7)	BT 4	Analyzing
2.	Mention the various sewer appurtenances used in a sewerage scheme. And state the location and utility of each.	BT 4	Analyzing
3.	(i) How will you estimate storm water flow? Discuss the factors influencing the storm water flow. (7) (ii) List out the factors influencing the dry weather flow and explain it in detail. (6)	BT 3	Applying
4.	Differentiate between 'sewage' and 'storm water' & Discuss the rational formula and its limitations in calculating the quantities of storm sewage.	BT 4	Analyzing
5.	A city with a population of 100,000 has an area of 50km^2. Rate of water supply is 110 litres per capita per day of which 80% turns into sewer. The average run-off coefficient is 0.5 and intensity of rainfall is 14.5mm/hr. Estimate the quantity of combined sewage. Take peak factor as 2.5.	BT 3	Applying
6.	Design a sewer running 0.7 times full at maximum discharge condition for serving a town with a population of 90,000 and provided with a water supply at 200litres/capita/day. Take slope as 1 in 400. Manning's constant N=0.013, peak factor as band sewage flow rate as 85% of water supplied.	BT 4	Analyzing
7.	Enumerate and explain the various sewer appurtenances and explain any two with neat sketches.	BT 4	Analyzing
8.	What point should be kept in mind locating the site of pumping stations? What are the requirements of a sewage pump?	BT 3	Applying
9.	How will you compute peak storm water discharge by the use of empirical formulas?	BT 4	Evaluating
10.	i. Discuss the choice available and the factors to be considered while selecting pumps and pipes for sewerage system and explain (6) ii.With help of neat sketch explain the location and functions of drop manhole 'inverted siphon'. (7)	BT 4	Analyzing
11.	During the construction of sewers how the centre line is marked on the ground and the excavation of the trenches is done?	BT 3	Applying
12.	i. Briefly describe the objectives, operations and maintenance issues pertaining to primary treatment of sewage. (8) ii. Describe in detail about grey water harvesting and its methods. (5)	BT 4	Analyzing
13.	i) Explain the factors influencing sanitary sewage flow and its estimation. (6) ii) State the classification of solids presents in sewage and the removal methods of each. (7)	BT 4	Analyzing
14.	i)Describe the laying of a sewer line in a trench.(6) ii) Compose the different sources of waste water that are produced from a community. Discuss the systems of sewerage with its merits and demerits. (7)	BT 3	Applying

15.	Design a sanitary sewer to serve a population of 5000 with per capita water supply rate of 110 lpcd. Assume n = 0.013	BT 4	Analyzing
16.	A town has a population of 1 lakh persons with a per capita water supply 0f 200 litres per day. Design a sewer running 0.7 times full at maximum flow condition. Take N = 0.013 at all depth of flow, slope 1 in 500 and peak factor of 3.	BT 3	Applying
17.	A combined sewer of circular section is to be laid to serve a particular area. Design the sewer from the following: Area to be served : 1000 hectares Population : 9000 Impermeability factor : 0.50 Time of entry : 3 min Time of flow : 17 min Rate of Water supply : 240 lpcd	BT 4	Analyzing
	PART C		
1.	The rainfall distribution of an area is as follows. The total area of the distribution is 36 hectares and the maximum rainfall is 5 mm/hour. Estimate the total runoff if the population density is 250/hectare.	BT 4	Analyzing
2.	Explain the various physio-chemical characteristics of sewage and state their environmental significance.	BT 4	Analyzing
3.	Design a sanitary sewer to a population of 6000 receiving water at rate of 90 lpcd. Minimum self-cleansing velocity at design flow is 0.8m/s. Maximum depth of flow is 0.5D. Assume other design criteria as applicable.	BT 4	Analyzing
4.	Explain in detail about the on-site sanitation and its methods and Show how it is followed in India and other countries.	BT 5	Evaluating
5.	What do you mean by explosion in sewers? Discuss different substances of explosion. Also mention the precautions to prevent explosion in sewers.	BT 5	Evaluating

TYPE OF AREA	% OF AREA	RUN OFF COEFFICIENT
Roof	20	0.9
Pavement	20	0.85
Housing	5	0.80
Roads	15	0.4
Lawns	35	0.1
Wooden area	5	0.05

UNIT IV - <u>SEWEAGE TREATMENT AND DESIGN PRINCIPLES</u>

Objectives-Selection of unit operations and process-Design principles of primary and secondary treatment, screen chamber, grit chamber, primary sedimentation tank, activated sludge process Modified activated sludge process and oxidation ditch Trickling filter, Stabilization ponds-Septic tank with soak pits - Sludge: Treatment and disposal.

PART A			
Q.NO	**QUESTIONS**	**BT LEVEL**	**COMPETENCE**
1.	Write the objectives of treatment of sewage.	BT 1	Remembering
2.	What is meant by detritus tank?	BT 1	Remembering
3.	What is the function of primary settling?	BT 1	Remembering
4.	Define on-site sanitation. What are the methods of onsite sanitation?	BT 1	Remembering
5.	What do you understand by secondary treatment?	BT 1	Remembering
6.	What are the three methods usually adopted for the disposal of septic tank effluent?	BT 1	Remembering
7.	Discuss the biological concept taking place in septic tank.	BT 2	Understanding
8.	What are the objectives of screen chamber?	BT 2	Understanding
9.	Distinguish the grit chamber with Plain Sedimentation tank.	BT 2	Understanding
10.	Examine how the velocity control device is necessary in grit chamber? Name the devices used.	BT 2	Understanding
11.	Enlist different type of trickling filter.	BT 2	Applying
12.	If a circular sedimentation tank of diameter 3.5 m treats 20 million litres of sewage daily, Calculate the applicable surface loading rate.	BT 2	Applying
13.	Define attached growth process.	BT 2	Applying
14.	State the objectives of grit removal.	BT 2	Understanding
15.	What do you understand by contact bed?	BT 1	Applying
16.	What is the necessity of grit chamber?	BT 2	Understanding
17.	How will you classify screens based on size of clear openings?	BT 1	Applying
18.	What do you understand by sludge Age and F/M ratio.	BT 1	Applying
19.	Write the headloss formula for screen chamber.	BT 2	Understanding
20.	Define sludge solids retention time in ASP design.	BT 2	Applying
21.	Identify the modified forms of conventional ASP.	BT 2	Understanding
22.	What is the function of aeration in Activated Sludge Process?	BT 2	Applying
23.	When will you prefer anaerobic treatment of sewage over an aerobic process?	BT 2	Understanding
24.	Define sludge volume index.	BT 2	Understanding
25.	Discuss the term re-circulation ratio in trickling filter.	BT 1	Remembering
PART B			
1.	Describe the steps involved in the design of septic tank. And also explain the working of a septic tank with neat sketch.	BT 4	Analyzing

2.	What is meant by sedimentation tank and explain its types with neat sketch.	BT 3	Applying
3.	i. Write the design criteria for a grit chamber and brief its construction and functioning. (8) ii. Describe the working of grit chamber and its types. (5)	BT 3	Applying
4.	i) Design a bar screen for a peak average flow of 30 million lit per day. (5) ii) Design a septic tank with dispersion pit for a hostel with a population of 150 and peak discharge of 205 Lit Per Min. Take desludging period as one year. Assume suitable design criteria and draw a neat sketch of the designed tank. (8)	BT 4	Analyzing
5.	i)Summarize the role of Screen Chamber in Sewage treatment plant and write its design procedure. (6) ii) Estimate the settling velocity of spherical particle of specific gravity 2.65 and diameter 0.18mm. Take kinematic viscosity of water as 1.016×10^{-2} m/s. (7)	BT 3	Applying
6.	i) Discuss in brief about the various types of settling and design considerations of sedimentation tanks. (6) ii) Design a rectangular sedimentation tank for treating 12MLD adopting L:B ratio as 2.5 and overflow rate $40m^3/m^2/day$. Assume Detention Time as 2 hours. (7)	BT 3	Applying
7.	Design a circular primary sedimentation tank to treat an average sewage flow of 5000 m^3/day, suitably assume. Draw a neat sketch of the designed tank.	BT 4	Analyzing
8.	An average operating data for conventional activated sludge treatment plant is a follows: (1) Wastewater flow = 35000 m^3/d (2) Volume of aeration tank = 10900m^3 (3) Influent BOD = 250 mg/l (4) Effluent BOD =20 mg/l (5) Mixed liquor suspended solids (MLSS) = 2500 mg/l (6) Effluent suspended solids = 9700 mg/l (7) Quantity of waste sludge = 220 m^3/d Based on the information above,determine: (a) Aeration period (hrs) (b) Food to micro- organisms ratio (F/M) (kg BOD per day/kg MLSS) (c) Percentage efficiency of BOD removal (d) Sludge age (days)	BT 4	Analyzing
9.	Explain, with the help of a flow chart, various processes involved in sludge treatment and disposal.	BT 4	Analyzing
10.	i. Classify the types of screens adopted in sewage treatment with neat sketch. (7) ii. Classify the different methods of dispersion trenches in a septic tank with neat sketch. (6)	BT 3	Applying
11.	Examine the components and the operational principles of activated sludge process with neat sketch. Write its advantages and disadvantages.	BT 3	Applying

12.	i. Examine the size of standard rate trickling filter to treat 6 million litres of sewage per day having BOD of 160 mg/l. Take hydraulic loading of $6m^3/m^2/d$ and organic loading of $0.35kg/m^3/d$. (7) ii) List in detail about the operational problem of standard rate trickling filters and their remedies. (6)	BT 3	Applying
13.	Explain in brief the principles of working of aerobic, anaerobic and facultative type stabilization ponds.	BT 4	Analyzing
14.	Estimate the size of a high rate trickling filter for the following data: Sewage flow = 4.5 MLD Recirculation ratio = 1.5 BOD of Raw sewage = 230 mg/l BOD removal in PST = 30% BOD of treated effluent required = 25 mg/l.	BT 4	Evaluating
15.	Design a grit chamber cum Detritus tank for a sewage treatment plant for sewage flow of 400 litres/sec. Assume the velocity of flow of 0.2 m/sec and the detention period of 120 sec. Assume the peak flow rate is 2.4 times the average flow.	BT 3	Applying
16.	Design a primary settling tank for a town of population 34000. The formation of sewage may be assumed at 150 litres/capita/day.	BT 4	Analyzing
17.	Design a septic tank for a small residential colony having a population of 500 persons. The rate of water supply is 150 litres per head per day. Design also the soak well, dispersion trench adopting infiltration rate as 1200 lit/m^2day.	BT 4	Analyzing
	PART C		
1.	Why the septic tank method of treating sewage is considered ineffective? Under what circumstances a septic tank method of treating sewage is preferred? Describe the various methods of disposal of septic tank effluent.	BT 5	Evaluating
2.	Discuss the operation and maintenance of sewage treatment plant.	BT 4	Analyzing
3.	Design a single stage high rate trickling filter for treating sewage of 4 ML/d with a raw sewage BOD equal to 300 mg/L. Assume a recirculation ratio of 1.5, BOD removal in PST as 35% and the final BOD of effluent as 20 mg/l.	BT 4	Analyzing
4.	Design a septic tank for the following data: No. of people = 100 Sewage/capita/day = 120 litres De-sludging period = 1 year Length : width = 4:1 What would be the size of its soak well if the effluent from the septic tank is to be discharged in it. Assume percolation rate through soak well is to be 1250 $l/m^3/d$.	BT 5	Evaluating
5.	Design sludge drying beds for digested sludge from an activated sludge plant, serving 1,20,000 persons.	BT 5	Evaluating
	UNIT V - <u>SEWAGE DISPOSAL AND RURAL SANITATION</u>		
Disposal on land-Sewage farming-Disposal into water bodies-Oxygen sag curve - Wastewater reclamation techniques-Sanitary fittings-one pipe and two pipe system general layout of house drainage connection.			

PART A			
Q.NO	**QUESTIONS**	**BT LEVEL**	**COMPETENCE**
1.	Enlist the methods of disposal of sewage by land treatment.	BT 1	Remembering
2.	Define sewage sickness.	BT 1	Remembering
3.	What is meant by self-purification of rivers?	BT 1	Remembering
4.	What is meant by disposal by dilution?	BT 1	Remembering
5.	Define dilution factor.	BT 1	Remembering
6.	List out the various natural forces of purification.	BT 1	Remembering
7.	Draw the oxygen deficit curve.	BT 2	Understanding
8.	A town discharges 50 m^3/s of secondary treated sewage into a stream having a rate of flow 1000m^3/s. The DO content of sewage is 0.5 mg/l and DO in the upstream side of the river is 58.5 mg/l. Find the DO of the mix.	BT 2	Understanding
9.	What are the methods of applying sewage effluents to farms?	BT 2	Understanding
10.	Examine the difference between effluent irrigation and sewage farming.	BT 2	Understanding
11.	Enlist sodium hazards in sewage farming.	BT 2	Applying
12.	What do you mean by soil dispersion system?	BT 2	Applying
13.	What is meant by land treatment in sewage disposal?	BT 2	Applying
14.	How sewage disposal affects public health?	BT 1	Remembering
15.	Write short notes on system of plumbing.	BT 1	Applying
16.	Differentiate between one pipe and two pipe system.	BT 1	Applying
17.	What do you understand by the house drainage plans?	BT 1	Applying
18.	List out the types of sewerage system.	BT 2	Applying
19.	Explain the pollution control board norms for effluent discharge into streams.	BT 1	Remembering
20.	Enlist various soil fittings in the house drainage system.	BT 2	Applying
21.	Why wastewater is to be reused.?	BT 1	Remembering
22.	Explain the requirements of the good sewer joints.	BT 2	Understanding
23.	What is the advantage in Two pipe system?	BT 2	Understanding
24.	What are the different zones of pollution?	BT 2	Understanding
25.	What is the ratio should be followed in disposing Wastewater in water bodies.	BT 2	Understanding

PART B			
1.	A large stream has a rate of re-aeration constant, Kr = 0.24 per day (to base 10) and de-oxygenation constant, K_d = 0.1 per day (to the base 10).The initial deficit of the mixture of stream and waste water at the point of reference D_o = 4 mg/l and the ultimate 5 day BOD, L_o = 35mg/l. Find the D.O deficit and critical time.	BT 4	Analyzing
2.	In Indian towns and cities, the land disposal method is mostly preferred. Why?	BT 4	Analyzing
3.	i) Draw a typical oxygen sag curve and explain its meaning and state its importance. (6) ii) Determine the BOD of river water at the discharge point of the treated sewage from a town having a BOD of 30mg/l discharged at the rate of 5 m^3/s into a river having a flow of 30m^3/s and no BOD. (7)	BT 3	Applying
4.	Explain briefly about the methods of sewage disposal.	BT 4	Analyzing
5.	What is sewage farming? What are its advantages over the method of disposal of sewage by dilution?	BT 3	Applying
6.	Explain the various zones of pollution in river stream.	BT 4	Analyzing
7.	Discuss briefly about the disposal of sewage in sea water.	BT 4	Analyzing
8.	Justify under which conditions, the effluent irrigation method for disposal of sewage can be adopted?	BT 3	Applying
9.	How will you apply sewage effluents to farms? and explain their methods in detail.	BT 4	Evaluating
10.	Name the various types of sanitary fittings. Describe any two with the help of neat sketch.	BT 4	Analyzing
11.	What is meant by sewage sickness and list out the preventive measure to control it?	BT 3	Applying
12.	Describe the one pipe and two pipe plumbing systems. Compare them with sketches.	BT 4	Analyzing
13.	State the classification of solids present in sewage and the removal methods of each.	BT 4	Analyzing
14.	Explain the important aspects associated with house service connection.	BT 3	Applying
15.	Explain the principle of house drainage system with neat sketch.	BT 4	Analyzing
16.	A waste water effluent of 560 l/s with a BOD = 50 mg/l, DO = 0.3 mg/l and temperature of 23^0C enters a river where the flow is 28 m3/s, and BOD = 4 mg/l, DO = 8.2 mg/l and temperature of 17^0C. k1 of the waste is 0.1 per day at 20^0C. the velocity of water in the river downstream is 0.18 m/s and depth of 1.2 m. Determine the combined discharge, BOD, DO and temperature.	BT 3	Applying
17.	Explain the wastewater reclamation techniques in a small colony and write the advantages of reclamation.	BT 4	Analyzing

PART C			
1.	Explain the “one” and “two” pipe system of plumbing and state the conditions under which they are adopted?	BT 4	Analyzing
2.	A city discharges 100 cumecs of sewage into a river, which is fully saturated with oxygen and flowing at the rate of 1500 cumecs during its lean days with a velocity of 0.1 m/s. The 5 days BOD of sewage at the given temperature is 280 mg/L. Find when and where the critical DO deficit will occur in the downstream portion of the river and what is its amount. Assume Coefficient of purification of the stream (f) as 4.0 and Coefficient of deoxygenation (K_D) as 0.1.	BT 4	Analyzing
3.	What are the environmental and health risks associated with sewage farming?	BT 4	Analyzing
4.	Summarise the principle of the self-purification process of river and the various stages of oxygen sag curve.	BT 5	Evaluating
5.	Draw a typical house drainage plan of a residential building.	BT 5	Evaluating