SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF CIVIL ENGINEERING

QUESTION BANK

VI SEMESTER

1903604- WATER SUPPLY AND WASTE WATER ENGINEERING

Regulation – 2019

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Prepared by

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SUBJECT CODE/NAME: 1903604 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 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.	BT-1	Remembering
6.	List functions of intake structures.	BT-1	Remembering
7.	Write down the formulae to find out head loss caused by pipe friction.	BT-2	Understanding
8.	List down the physical and chemical characteristics of water.	BT-2	Understanding
9.	What are the different types of surface and ground water sources?	BT-2	Understanding
10.	How will you calculate total head in the design of pumps for water supply schemes?	BT-2	Understanding
11.	Explain the points to be observed in selecting a pump.	BT-3	Applying

12.	List the sources of water supply.	BT-3	Applying
13.	List out the factors affecting per capita demand.	BT-3	Applying
14.	What is the main reason for seasonal variations in water demand?	BT-4	Analyzing
15.	What is water demand? State its types.	BT-4	Analyzing
16.	Write down the methods to calculate fire demand.	BT-4	Analyzing
17.	What are the components of water supply system?	BT-5	Evaluating
18.	Determine the fire demand for a city with a population of 3500 using freeman's formula.	BT-5	Evaluating
19.	What is the principle of centrifugal pump and reciprocating pumps?	BT-6	Creating
20.	What are the external forces acting on water transmission main if the pipe is laid under heavy traffic?	BT-6	Creating
21.	Summarize the situation in which pumps will be connected i.Series ii.Parallel.	BT-2	Understanding
22.	Mention the basis for the selection of types and capacity of pumps.	BT-3	Applying
23.	What is the difference between system curve and pump curve?	BT-4	Analyzing
24.	What is meant by economic diameter of a pumping main?	BT-5	Evaluating
25.	List out any two appurtenances in water conveyance system.	BT-6	Creating

PART B

1.	Explain the sources of water.	BT-1	Remembering
2.	Explain the classification of wells.	BT-1	Remembering
3.	What is design period? And what are factors governing it?	BT-1	Remembering
4.	Explain the factors affecting per capita demand.	BT-2	Understanding
5.	Explain the characteristics of water.	BT-2	Understanding
6.	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)	BT-3	Applying
7.	State all the population forecasting methods and explain.	BT-3	Applying
8.	The population of 5 decades from 1930 to 1970 are given below. Year | 1930 | 1940 | 1950 | 1960 | 1970 Population | 25000 | 28000 | 34000 | 42000 | 47000 Find out the population after one, two and three decades beyond the last known decade by using arithmetic increase	BT-1	Remembering

<table>
<tr><td></td><td>demand.</td><td></td><td></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-4</td><td>Analyzing</td></tr>
<tr><td>10.</td><td>Determine the future population of a satellite town by geometric increase method for the year 2011 with the following data.
<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-4</td><td>Analyzing</td></tr>
<tr><td>11.</td><td>Explain the different types of pumps used in water supplies with a neat sketch.</td><td>BT-5</td><td>Evaluating</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-2</td><td>Understanding</td></tr>
<tr><td>13.</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.</td><td>BT-4</td><td>Analyzing</td></tr>
<tr><td>14.</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-6</td><td>Creating</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-2</td><td>Understanding</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-1</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-4</td><td>Analyzing</td></tr>
<tr><td>4.</td><td>Explain the effects of variations in demand on the design capacities of different components of a water supply scheme.</td><td>BT-6</td><td>Creating</td></tr>
</table>

UNIT II - DESIGN PRINCIPLES OF WATER TREATMENT

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.

PART A

Q.NO	QUESTIONS	BT LEVEL	COMPETENCE
1.	Define: Detention time and surface overflow rate.	BT-1	Remembering
2.	List out advantages of rapid sand filter.	BT-1	Remembering
3.	Mention the advantages of chlorine, as disinfectant.	BT-1	Remembering
4.	State the function of sedimentation tanks.	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.	Compare the objectives of Screen chamber and Grit chamber.	BT-3	Applying
12.	Explain the factors influencing settling of discrete particles.	BT-3	Applying
13.	Define detention time and surface overflow rate for a sedimentation tank	BT-3	Applying
14.	Classify filter into different categories.	BT-4	Analyzing
15.	Explain the term coagulation.	BT-4	Analyzing
16.	Rewrite stokes equation for finding settling velocity of particles.	BT-4	Analyzing
17.	Write the nature of any four coagulants.	BT-5	Evaluating
18.	Define reverse osmosis.	BT-5	Evaluating
19.	Differentiate between demineralization and desalination.	BT-6	Creating
20.	Describe about the term water softening.	BT-6	Creating
21.	Define Defluoridation.	BT-2	Understanding

22.	Examine how to remove iron and manganese from water.	BT-3	Applying
23.	Briefly explain 'Nalgonda Technique'.	BT-4	Analyzing
24.	Summarize the methods of deflouridation.	BT-5	Evaluating
25.	Show the methods of removing temporary and permanent hardness	BT-6	Creating
	PART B		
1.	i. Develop the design for a rectangular sedimentation tank for 5MLD flow. (7) ii.Draw and label the parts of the rectangular sedimentation tank (Longitudinal section) indicating the various zones. (6)	BT-1	Remembering
2.	Explain about slow sand filter and rapid sand filter with suitable diagram and also write their advantages over them.	BT-1	Remembering
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-1	Remembering
4.	Discuss the design aspects of sedimentation tanks in detail.	BT-2	Understanding
5.	The maximum daily demand at a water purification plan 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-2	Understanding
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.	What is disinfection? Identify the factors affecting disinfection. Examine the conventional and modern methods which are used to disinfect water.	BT-3	Applying
8.	Explain the various methods of removing excess Iron and Manganese from Ground water.	BT-1	Remembering
9.	Elaborate, how are defluoridation and demineralization carried out in the advanced water treatment process.	BT-4	Analyzing
10.	The analysis of a hard water shows the following compositions. Free carbon dioxide = 3 mg/liter Alkalinity = 68 mg/liter Non carbonate hardness = 92 mg/liter Total magnesium = 15 mg/liter	BT-4	Analyzing

	Assume that it is possible to remove all but 35 mg/liter of carbonate hardness with lime, and that the treated water is to have a total hardness of 80 mg/liter. Determine the amount of lime and soda required for treatment per million liter of raw water.		
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-5	Evaluating
12.	Design a zeolite softener for an industrial establishment working for 2 shifts of 8 hours each for the following data and draw a neat sketch of the unit. i. Soft water requirement = 2.5 ML/d in 16hours ii. Raw water hardness = 800 mg/L as$CaCo_3$ iii. Product water hardness =50 mg/L as $CaCo_3$ iv. Exchange capacity of the resin = 35 kg$(CaCO_3)/m^3$ Salt required for regeneration = 50 kg (NaCl)/m^3 of resin.	BT-2	Understanding
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-6	Creating
	PART C		
1.	i. Explain briefly on Breakpoint chlorination. (9) ii. Discuss the role of sedimentation tank in water treatment. (6)	BT-2	Understanding
2.	Show the mechanism of sand filtration. Draw a neat sketch of filter units and explain its working principle.	BT-1	Remembering
3.	Write a note on Iron removal from water for small communities.	BT-4	Analyzing
4.	Explain the different methods of Water Softening.	BT-6	Creating
	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 LEVEL**	**COMPETENCE**
1.	Define time of Concentration.	BT-1	Remembering
2.	Define sewage.	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-1	Remembering
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	Understanding
11.	What is the use of manhole in sewerage system?	BT-3	Applying
12.	List out the various sewer appurtenances.	BT-3	Applying
13.	Distinguish between Self Cleaning velocity and Non-scouring velocity.	BT-3	Applying
14.	Differentiate between one pipe and two pipe system.	BT-4	Analyzing
15.	State the advantages of egg-shaped sewer sections.	BT-4	Analyzing
16.	The 5 day BOD of sewage is 240 mg/l. Invent the BOD load in Kg/d for 100 cu.m/day of sewage?	BT-4	Analyzing
17.	Explain the pollution control board norms for effluent discharge into streams.	BT-5	Evaluating
18.	How will you save rain water at household level?	BT-5	Evaluating
19.	What is trap? State its quality requirements.	BT-6	Creating
20.	What is meant by the term population equivalent?	BT-6	Creating
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-3	Applying
23.	What is meant by grey water?	BT-4	Analyzing
24.	List out the types of sewerage system.	BT-5	Evaluating
25.	Explain the requirements of the good sewer joints.	BT-6	Creating
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-1	Remembering
2.	List out the factors influencing the dry weather flow and explain it in detail.	BT-1	Remembering
3.	(i) How will you estimate storm water flow? Discuss the factors influencing the storm water flow. (7)	BT-1	Remembering

	(ii). What is population equivalent? State its uses. (6)		
4.	i) Differentiate between 'sewage' and 'storm water' & Discuss the rational formula and its limitations in calculating the quantities of storm sewage. (7) ii) Describe the one pipe and two pipe plumbing systems. Compare them. (6)	BT-2	Understanding
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-2	Understanding
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-3	Applying
7.	Enumerate and explain the various sewer appurtenances with neat sketches.	BT-3	Applying
8.	Calculate the combined flow discharge of sewage for the given data. Area to be served is 150 hectares. Population density is 50,000. Time of entry is 5 minutes. Time of flow is 20 minutes. Rate of water supply is 135 LPCD. Impermeability factor = 0.45. Assume 80% of water supplied turns into sewer and peak factor as 1.5.	BT-1	Remembering
9.	How will you compute peak storm water discharge by the use of empirical formulas?	BT-4	Analyzing
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.	i) The BOD of sewage incubated for one day at 30°C has been found to be 400 mg/l. Calculate the 5 day 20°C BOD. Assume K_{10}= 0.12/day at 20°C. (8) ii) A city with a population of 100,000 has an area of hectares. Calculate the D.W.F and storm water flow for the sewer line for the following data: i. Rate of Water supply = 200 LPCD ii. Average runoff coefficient for the entire area = 0.5 iii. Time of concentration = 50 min Assume 75% of water supplied reaches the sewer. (7)	BT-5	Evaluating
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-2	Understanding
13.	i) Explain the factors influencing sanitary sewage flow and its estimation. (6) ii) State the classification of solids present in sewage and the	BT-4	Analyzing

	removal methods of each. (7)		
14.	i)Generalize how will you estimate the relative stability of sewage? (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-6	Creating
	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-2	Understanding
2.	Explain the various physio-chemical characteristics of sewage and state their environmental significance.	BT-1	Remembering
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-6	Creating

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.	Quote the objectives of preliminary 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 is meant by septic tank? Show the different methods of dispersion trenches in septic tank.	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.	Show the Stoke's equation for discrete particle settling.	BT-3	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-3	Applying
13.	Compare coagulation and Flocculation.	BT-3	Applying
14.	State the objectives of grit removal.	BT-4	Analyzing
15.	Identify the significance of Weir loading rate in Sedimentation tank unit.	BT-4	Analyzing
16.	Explain about grit chamber and their design criteria.	BT-4	Analyzing
17.	How will you classify screens based on size of clear openings?	BT-5	Evaluating
18.	What process is involved in sedimentation?	BT-5	Evaluating
19.	Construct the design criteria for screen chamber.	BT-6	Creating
20.	Define sludge solids retention time in ASP design.	BT-6	Creating
21.	Identify the modified forms of conventional ASP.	BT-2	Understanding
22.	What is the function of aeration in Activated Sludge Process?	BT-3	Applying
23.	When will you prefer anaerobic treatment of sewage over an aerobic process?	BT-4	Analyzing
24.	Define sludge volume index.	BT-5	Evaluating
25.	Discuss the term re-circulation ratio in trickling filter.	BT-6	Creating
	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-1	Remembering
2.	What is meant by sedimentation tank and explain its types with neat sketch.	BT-1	Remembering
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-1	Remembering

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-2	Understanding
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-2	Understanding
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-3	Applying
8.	Design a screen and grit chamber for a proposed sewage treatment plant (STP) of 60 MLD.	BT-1	Remembering
9.	Examine and design a septic tank for the following data:- i. No of persons = 140 ii. Sewage contribution = 120 LPCD iii. Desludging period = 1 year iv. Length : Breadth ratio = 1 :2.5 Design a dispersion trench adopting infiltration rate as 1200 lit/m^2day	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-4	Analyzing
11.	Examine the components and the operational principles of activated sludge process with neat sketch. Write its advantages and disadvantages.	BT-5	Evaluating
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-2	Understanding
13.	Design a septic tank with dispersion trench for 175 users. The rate of water supply is 70 LPCD. Assume suitable criteria as applicable. Draw a neat sketch of the unit.	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	BT-6	Creating

	BOD of Raw sewage = 230 mg/l BOD removal in PST = 30% BOD of treated effluent required = 25 mg/l.		
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-2	Understanding
2.	Discuss the operation and maintenance of sewage treatment plant.	BT-1	Remembering
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-6	Creating
UNIT V - SEWAGE DISPOSAL AND RURAL SANITATION			
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.	Describe 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	BT-2	Understanding

	58.5 mg/l. Find the DO of the mix.		
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-3	Applying
12.	What do you mean by soil dispersion system?	BT-3	Applying
13.	What is meant by land treatment in sewage disposal?	BT-3	Applying
14.	How sewage disposal affects public health?	BT-4	Analyzing
15.	Distinguish between Self Cleaning velocity and Non-scouring velocity.	BT-4	Analyzing
16.	Differentiate between one pipe and two pipe system.	BT-4	Analyzing
17.	The 5 day BOD of sewage is 240 mg/l. Invent the BOD load in Kg/d for 100 cu.m/day of sewage?	BT-5	Evaluating
18.	List out the types of sewerage system.	BT-5	Evaluating
19.	Explain the pollution control board norms for effluent discharge into streams.	BT-6	Creating
20.	How will you save rain water at household level?	BT-6	Creating
21.	What is meant by the term population equivalent?	BT-2	Understanding
22.	Explain the requirements of the good sewer joints.	BT-3	Applying
23.	List out the sources of domestic sewage.	BT-4	Analyzing
24.	What are the different zones of pollution?	BT-5	Evaluating
25.	List out any 5 standards for discharge of sewage in surface water source.	BT-6	Creating
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-1	Remembering
2.	In Indian towns and cities, the land disposal method is mostly preferred. Why?	BT-1	Remembering
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-1	Remembering

4.	Explain briefly about the methods of sewage disposal.	BT-2	Understanding
5.	What is sewage farming? What are its advantages over the method of disposal of sewage by dilution?	BT-2	Understanding
6.	Explain the various zones of pollution in river stream.	BT-3	Applying
7.	Discuss briefly about the disposal of sewage in sea water.	BT-3	Applying
8.	Justify under which conditions, the effluent irrigation method for disposal of sewage can be adopted?	BT-1	Remembering
9.	How will you apply sewage effluents to farms? and explain their methods in detail.	BT-4	Analyzing
10.	A waste water treatment plant produces sludge of 1000kg dry solids per day with a moisture content of 97%. The solids are 65% volatile with specific gravity 1.05 and inorganic solids of specific gravity 2.55. Determine the sludge volume of raw sludge, after dewatering to 70% and after incineration.	BT-4	Analyzing
11.	What is meant by sewage sickness and list out the preventive measure to control it?	BT-5	Evaluating
12.	Describe the one pipe and two pipe plumbing systems. Compare them with sketches.	BT-2	Understanding
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-6	Creating
	PART C		
1.	Explain the “one” and “two” pipe system of plumbing and state the conditions under which they are adopted?	BT-2	Understanding
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-1	Remembering
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-6	Creating