WATER SUPPLY AND WASTE WATER ENGINEERING

2MARK QUESTIONS

CHAPTER-I

1. What is hydrological cycle?
2. List the sources of water supply.
3. Mention different types of intakes.
4. What is shallow well?
5. What is infiltration gallery?
6. Define spring.
7. What are the different types of springs?
8. Name the types of wells.
9. Define deep well.
10. What is precipitation?
11. List the sources of water supply.
12. List out the factors affecting per capita demand.
13. What is shallow well?
14. What is infiltration gallery?
15. Define spring.
16. What are the different types of springs?
17. Name the types of wells.
18. Define deep well.
19. What is precipitation?
20. What is the main reason for seasonal variations in water demand?

21. What is water demand? State its types.

22. Write down the methods to calculate fire demand.

23. What are the components of water supply system?

CHAPTER-II

1. Define intake.

2. List functions of intake structures.

3. List out the various joint's in cast iron pipes.

4. Name the types of intake according to their position.

5. How the corrosion of metal pipes is reduced?

6. Predict the factors controlling the choice of materials for water conduits.

7. Illustrate the properties of Ductile Iron pipes.

8. Compare gravity conduits with pressure conduits

9. What are the advantages and limitations of RCC pipes?

10. Write down the formulae to find out head loss caused by pipe friction.

11. Define pipe appurtenances and identify their role.

12. Highlight the criteria required for the pipe materials in the water supply system.

13. Explain about economic diameter of a pumping main.

14. How will you calculate total head in the design of pumps for water supply schemes?

15. Explain the various pipe appurtenances used in water conveyance system.

16. Explain the points to be observed in selecting a pump.

17. What is the principle of centrifugal pump and reciprocating pumps?

18. Estimate the head loss in a C.I transmission main 300mm in diameter and 2 km in length with C=100, when it carries a flow of 10m3 /min.

19. What are the external forces acting on water transmission main if the pipe is laid under heavy traffic?

20. Summarize the situation in which pumps will be connected in i. Series ii. Parallel.

21. Mention the basis for the selection of types and capacity of pumps.

22. What is the difference between system curve and pump curve?

23. What is meant by economic diameter of a pumping main?

24. List out any two appurtenances in water conveyance system.

25. Define Hydraulic ram

CHAPTER-III

1. Define: Detention time and surface overflow rate.

2. Give the design criteria for flash mixer and state its use in water supply Scheme.

3. List out advantages of rapid sand filter.

4. Mention the advantages of chlorine, as disinfectant.

5. State the function of sedimentation tanks.

6. Examine significance of velocity gradient in flash mixer.

7. Differentiate between unit operation and unit process.

8. Discuss the significances of velocity gradient in flocculator design.

9. Differentiate between sterilization and disinfection.

10. Describe the tests to be done to find the residual chlorine in water.

11. Illustrate the mechanism of disinfection process.

12. Discover the factors which depends the dose of coagulants.

13. Show the layout plan of water treatment plant.

14. Compare the objectives of Screen chamber and Grit chamber.

15. Explain the factors influencing settling of discrete particles.

16. What are the steps required for the maintenance aspects of water treatment plant?

17. Explain the term coagulation.

18. Rewrite stokes equation for finding settling velocity of particles.

19. Write the nature of any four coagulants.

20. Summarize about break point chlorination.

21. What are Flocculators?

22. How to manage residue in water treatment plant?

23. Define detention time and surface overflow rate for a sedimentation tank

24. Classify filter into different categories.

25. What are the residues generated from a water treatment plant?

CHAPTER-IV

1. Define reverse osmosis.

2. List out the various types of aerators used in water treatment.

3. Define Zeolite process.

4. What is meant by adsorption isotherm?

5. List any four effects of hardness in water

6. How do you regenerate softener?

7. Distinguish between physical adsorption and chemical adsorption

8. Differentiate between demineralization and desalination.

9. Describe about the term water softening.

10. What are the recent advances in water treatment process?

11. What is the principle of Demineralization by Ion-exchange?

12. Define Defluoridation.

13. Examine how to remove iron and manganese from water.

14. Explain the methods of demineralization.

15. Briefly explain 'Nalgonda Technique'.

16. Summarize the methods of deflouridation.

17. What are Membrane Bioreactors?

18. Rewrite the maximum permissible limit of fluoride in drinking water.

19. Recommend any four methods of desalination process.

20. Discuss the unit processes applied to remove iron and manganese from water.

21. How do you protect water treatment plants from corrosion?

22. Name the effects of excess fluoride content in drinking water.

23. Define RO reject management.

24. Show the methods of removing temporary and permanent hardness.

25. Write a short note on water-softening by lime-soda process.

CHAPTER-V

1. What is an equivalent pipe?

2. What is meant by appurtenances?

3. Mention the important components needed for the water distribution to buildings.

4. Where the ring system of water distribution system is adopted?

5. What are the requirements of water distribution system?

6. Name the appurtenances used in water distribution system.

7. Describe about air valves. Mention the different types of air valves.

8. Extend a few lines on ferrule in water service connection.

9. Predict the factors which control water supply to buildings.

10. Discuss the methods available to find the leakages in pipelines.

11. Illustrate few lines on hydraulically balanced network.

12. Examine the prime functions of service reservoirs.

13. Illustrate the methods of distribution of water.

14. Analyze how to identify leakage in pipelines.

15. Compare gravity system of distribution and pumping system of distribution.

16. Explain Hardy Cross method of pipe network analysis.

17. Rewrite anyone of the empirical formula to relate pressure to height in distribution system.

18. Invent the methods of leak detection in water distribution system.

19. Discuss the general methods of distribution of water employed in Municipal water supply scheme.

20. Summarize the role of computer application in water supply system.

21. Highlight the important aspects related to leak detection.

24. List out the components of service connection pipe.

25. How will you calculate the service capacity of the reservoir?

CHAPTER-VI

1. Define time of Concentration.

2. Define sewage.

3. Name the sewage characteristics with which organic matter concentration is expressed.

4. Show the BOD demand curve.

5. Examine the necessity of legal requirements and effluents disposal of sewage.

6. Identify the significance of BOD/COD ratio.

7. Differentiate between dry weather flow and wet weather flow.

8. Discuss the various sources of waste water

9. Discuss how do you estimate storm run-off?

10. List out the sources of domestic sewage.

11. Examine the impacts of nutrients on water bodies?

12. What is the use of manhole in sewerage system?

13. List out the various sewer appurtenances.

14. Explain the necessity of wastewater characterization.

15. Distinguish between Self Cleaning velocity and Non-scouring velocity.

16. Differentiate between one pipe and two pipe system.

17. State the advantages of egg-shaped sewer sections.

18. The 5 day BOD of sewage is 240 mg/l. Invent the BOD load inKg/d for 100 cu.m/day of sewage?

19. List out the types of sewerage system.

20. Explain the pollution control board norms for effluent discharge into streams.

21. How will you save rain water at household level?

22. What is trap? State its quality requirements.

23. When does it become necessary to provide manhole in sewerage system?

24. What is meant by the term population equivalent?

CHAPTER-VII

1. 1. Quote the objectives of preliminary treatment of sewage.

2. What is meant by detritus tank?

3. What is the function of primary settling?

4. Define on-site sanitation .What are the methods of onsite sanitation?

5. What is meant by septic tank? Show the different methods of dispersion trenches in septic tank.

6. What are the three methods usually adopted for the disposal of septic tank effluent?

7. Differentiate between unit operations and unit processes in wastewater treatment. Give at least two examples in each.

8. What are the objectives of screen chamber?

9. Discuss the biological concept taking place in septic tank.

10. Distinguish the grit chamber with Plain Sedimentation tank.

11. Examine how the velocity control device is necessary in grit chamber. Name the devices used.

12. Show the Stoke's equation for discrete particle settling.

13. If a circular sedimentation tank of diameter 3.5 m treats 20 million litres of sewage daily, Calculate the applicable surface loading rate?

14. Compare coagulation and Flocculation.

15. State the objectives of grit removal.

16. Identify the significance of Weir loading rate in Sedimentation tank unit?

17. Explain about grit chamber and their design criteria.

18. How will you classify screens based on size of clear openings?

19. What process is involved in sedimentation?

20. Construct the design criteria for screen chamber.

21. What is meant by grey water?

22. List down the unit operations in primary treatment.

23. Define coagulant.

24. Define detention time.

25. Why maintenance is important for primary treatment units?

CHAPTER-VIII

1. List the objectives of Secondary and Tertiary treatment of sewage.

2. Define sludge solids retention time in ASP design.

3. Identify the modified forms of conventional ASP.

4. What is the function of aeration in Activated Sludge Process?

5. When will you prefer anaerobic treatment of sewage over an aerobic process?

6. Define sludge volume index.

7. Discuss the term re-circulation ratio in trickling filter.

8. Distinguish between suspended growth processes and attached growth processes with suitable examples.

9. Illustrate how advanced treatment of sewage is different from conventional treatment system.

10. Classify trickling filter and state its types?

11. Examine hydraulic loading rate of a trickling filter?

12. State the advantages of UASB reactor.

13. Compare the oxidation ditch with oxidation pond.

14. What is the difference between reclamation and reuse of sewage.

15. Distinguish between HRT and SRT.

16. What is meant by MLVSS?

17. Differentiate between aerobic pond and anaerobic pond.

18. Summarize about sludge recycling.

19. Explain how do you determine organic loading rate of a trickling filter?

20. Compare activated sludge process and trickling filter process of sewage treatment.

21. Write the formula for recirculation factor.

22. Define F/M ratio.

23. List out the types of high rate filters.

24. Write down the components of UASB reactor.

25. What is the role of stabilization ponds in secondary treatment of sewage?

CHAPTER-IX

1. Describe the methods of disposal of sewage by land treatment.

2. Define sewage sickness.

3. What is meant by self-purification of rivers?

4. What are the different zones of pollution?

5. What is meant by disposal by dilution?

6. Define dilution factor.

7. List out the various natural forces of purification.

8. Draw the oxygen deficit curve.

9. A town discharges 50 m3/s of secondary treated sewage into a stream having a rate of flow 1000m3/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.

10. What are the methods of applying sewage effluents to farms?

11. Examine the difference between effluent irrigation and sewage farming.

12. List out any 5 standards for discharge of sewage in surface water source.

13. What do you mean by zone of recovery?

14. Write down the streeter-phelps equation.

15. Under what condition, the effluent irrigation method for disposal of sewage can be favourably adopted?

16. Enlist the preventive measures for sewage sickness.

17. Define Mass balance Principle.

18. Why land disposal method is generally found to be a better choice in hot climatic areas?

19. What are the factors influencing the rate at which oxygen is supplied by the atmosphere to the polluted water?

20. Define SAR.

21. Enlist sodium hazards in sewage farming.

22. What do you mean by soil dispersion system?

23. What is meant by land treatment in sewage disposal?

24. How sewage disposal affects public health?

25. What do you understand by dilution and under what circumstances it is most suitable?

CHAPTER-X & XI

1. List the different unit processes involved in sludge treatment.

2. What is the difference between raw sludge and secondary sludge?

3. Why sludge treatment is necessary

4. Summarize the objectives of sludge thickening and its method.

5. What is meant by acid production and acid regression?

6. Enlist the factors affecting sludge digestion.

7. Define sludge seeding.

8. Distinguish between mesophilic digestion and thermophilic digestion.

9. Sewage has suspended solid contents as 250 mg/L. the sedimentation tank removes 55% of the suspended solids and water content of the sludge is 95%. Determine the quantity of sludge produced after treating 6.5 MLD.

10. Define sludge conditioning.

11. What are the factors to be considered while designing sludge digestion tank.

12. Discuss the objectives of treatment of sludge.

13. What are the steps involved in sludge treatment?

14. What is meant by ripened sludge?

15. Examine the need for sludge digestion?

16. Determine the percentage reduction in volume of sludge if moisture content of sludge is reduced from 98% to 92%.

17. Examine the various methods of sludge dewatering

18. List out the common methods of sludge disposal.

19. Examine how does one improve the dewatering ability of sludge?

20. What are the different equipments used in sludge thickening?

21. List out the processes involved in anaerobic sludge digestion

22. Define period of intensive digestion.

23. Sketch the effect of temperature on the digestion period.

24. What is meant by multistage digestion.

25. Define supernatant liquor.

5&7 MARKS

CHAPTER-I

1. Explain the sources of water.

2. Explain the classification of wells.

3. What are points should be kept in mind while selecting a site for intake structure?

4. Explain any one of intake structure with neat sketch.

6. What is design period? And what are factors governing it?

7. State all the population forecasting methods and explain.

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 demand.

9. Explain the laboratory procedure to determine the chlorides, turbidity, sulphates and odor.

10. Determine the future population of a satellite town by geometric increase method for the year 2011 with the following data. Year 1951 1961 1971 1981 2011 Population in 1000s 93 111 132 161 ?

11. For a city of population 1L, find the following in connection with the water distribution system. i. Daily water demand. ii. Daily variation in water demand. iii. Monthly variation in water demand. iv. Hourly variation in water demand. v. Fire demand.

12. Enumerate and explain the various forms of ground water sources.

13. The population of a locality is given below Year Population 1880 1890 1900 1910 1920 1930 1940 1950 1960 8000 12000 17000 22500 29000 37500 47000 57000 66500 Estimate the population of the locality in 1980 by incremental method.

14. Describe how you would arrive at the total quantity of water to be supplied for a metropolitan area.

15. Briefly discuss about the various physicochemical test on water and write their limitation for domestic and industrial purpose.

16. Enumerate and explain the characteristics of surface water and ground water. And state their environmental significance.

17. i. Explain the different methods of forecasting future population of a city for which a water supply scheme is to be planned. ii. The population statistics of a town are given below Year 1930 1940 1950 1960 1970 Population 70000 100000 150000 200000 240000 Estimate the population expected in 1980 by arithmetical and geometrical increase methods.

18. Explain the effects of variations in demand on the design capacities of different components of a water supply scheme.

CHAPTER-II

1. i. List out the important considerations which govern the selection of site of an intake structure? ii. Describe the salient features of river intake with the aid of a neat sketch.

2. What are the basic requirements of a pipe joint? Describe the various pipe joints with neat sketches.

3. Discuss about the wet and dry intake tower to draw water from the reservoir.

4. Classify the types of intakes. Also explain the working of a reservoir intake with a neat sketch.

5. 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 CH =130 in Hazen's formula.

6. Describe in detail about the Hydraulics of flow in pipes.

7. i). List the requirements of a good piping material. ii). Quantity of water required by a town is 20,000m3 /day. The pumps are working against a total head of 40m, for 8hours.Total length of the main is 20km, f=0.075. Design the size of the main using Darcy-Weisbach formula. Assume any other data required.

8. i. List the factors to be considered in the selection of Pipe material for water transmission and describe it brieflyii. Explain the methods of transmission main system.

9. What are the different types of pipe materials used in the water transmission?

10. Summarize few lines about the functioning of a jet pump with a neat sketch.

11. Illustrate the different types of pipe appurtenances used in water supply project.

12. How to select pumps and pipe materials for water supply systems? Also Discuss the factors which are required to be considered in the selection of the type of a pump.

13. Explain the different types of pumps used in water supplies with a neat sketch.

14. i. Prepare the key features of testing and laying of pipeline. (8) ii.Explain the principle operation of a centrifugal pump with neat sketch.

15. 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.

16. Explain the types of Conduits in detail with neat sketches.

17. i. Explain briefly the steps involved in water supply pipe line installation. ii. Write brief notes on laying pipe lines and testing of pipelines.

18. Give a detailed account on the selection of pumps and pipe materials suitable for the conveyance system.

CHAPTER-III

1. i. Develop the design for a rectangular sedimentation tank for 5MLD flow. ii. Draw and label the parts of the rectangular sedimentation tank (Longitudinal section) indicating the various zones.

2. Estimate the volume of a clariflocculator for a proposed water treatment plant with a capacity of 80 ML/d and draw a neat sketch of the unit.

3. i. Estimate the settling velocity of a particle of 0.06 mm diameter having specific gravity of 2.65 in temperature of 20˚C. Take kinematic viscosity as 1.007 x 10-6 m 2 / sec. ii. Write the design principles of flash mixer and flocculator

4. Explain about slow sand filter and rapid sand filter with suitable diagram and also write their advantages over them.

5. 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/m2 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.

6. Discuss the design aspects of sedimentation tanks in detail.

7. Describe Chlorination and its types. Explain the various process or methods.

8. 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.

9. i. Chlorine usage in a treatment of 20000 m3 /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. ii. Illustrate the various unit operations and unit processes involved in water treatment.

10. i. Explain the sedimentation by coagulation process using alum and state the merits and demerits of using alum. ii. Examine the quality requirements of a disinfectant?

11. i. Design a flash mixer for a proposed water treatment plant with a capacity of 25 ML/d and draw a neat sketch of the unit. ii. Prepare a short note on “Break Point Chlorination”.

12. Design a rapid sand filter unit for 4 MLD of supply.

13. Explain about the process carried out in sedimentation tanks and sand filters during water treatment operation.

14. What is disinfection? Identify the factors affecting disinfection. Examine the conventional and modern methods which are used to disinfect water.

15. i. It is required to supply water to a population of 20000 at per capita demand of 150 liters/day. The disinfectant used for chlorination is bleaching powder which contains 30% of available chlorine. Determine how much of bleaching powder is required annually at the waterworks if 0.3 ppm of chlorine dose is required for disinfection. ii. With a neat sketch explain briefly about pulsatorclarifier.

16. Show the mechanism of sand filtration. Draw a neat sketch of filter units and explain its working principle.

17. Explain about the practices adopted in Residue management

18. i. Explain briefly on Breakpoint chlorination. ii. Discuss the role of sedimentation tank in water treatment.

CHAPTER-IV

1. Explain the various methods of removing excess Iron and Manganese from Ground water.

2. Describe in detail about the principle and mechanism of desalination process.

3. Elaborate, how are defluoridation and demineralization carried out in the advanced water treatment process.

4. What are the effects of excess concentration of Fluoride in water? And list the methods available for defluoridation and explain any one of them.

5. The analysis of 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 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/litter. Determine the amount of lime and soda required for treatment per million litter of raw water.

6. i. Describe the types of hardness present in water(ii) Discuss about the Ion exchange method of water softening with a sketch

7. Explain the methods of removing temporary and permanent hardness from water.

8. Illustrate a schematic diagram of a DM plant and explain the mechanism of cations as well as anions removal. Also, briefly outline the design procedure.

9. Explain the Zeolite process for the removal of permanent hardness from water.

10. i. Why and what pretreatment is required in the feed water to RO plant? ii. Explain the techniques adopted in RO reject management.

11. 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 asCaCo3 iii. Product water hardness =50 mg/L as CaCo3 iv. Exchange capacity of the resin = 35 kg(CaCO3)/m3 v. Salt required for regeneration = 50 kg (NaCl)/m3 of resin.

12. Explain in detail with neat sketches about the Membrane Bioreactor (MBR) process.

13. Explain the activated carbon treatments and pollutants removed and advantages of the process.

14. Recommend the various techniques involved in defluoridation.

15. Write a note on Iron removal from water for small communities.

16. Explain the different methods of Water Softening.

17. Write notes on i. Prasanthi technique ii. Reverse osmosis iii. Nalgonda technique

18. With neat sketches explain desalination by Electro dialysis method and RO process.

CHAPTER-V

1. What are the functions of service reservoir? Briefly outline the design aspects of service reservoir.

2. Draw a sketch and label the parts of a water supply service connection from the street main to a residential building and state the functions of each fitting.

3. What is the role of computer applications in the water distribution system?

4. Explain the principles of design of water supply in buildings.

5. Discuss with neat sketches the various types of layout of distribution system and state their advantages and disadvantages.

6. Classify the different plumbing systems with neat sketches. Also compare them for their cost, efficiency, easiness, etc.

7. Explain the “one” and “two” pipe system of plumbing and state the conditions under which they are adopted?

8. Discuss in detail about i. Wastewater detection method. ii. Various pipe fitting with neat sketches.

9. Give a detailed account on the key requirements of water distribution.

10. Explain with neat sketches about the appurtenances, fixtures and fittings in water distribution system

11. Summarize few lines about leak detection and explain its methods. How to maintain the drinking water pipeline system.

12. Explain the important aspects associated with house service connection.

13. Discuss Hardy-cross method and Equivalent pipe method to analyze complex pipe network.

14. Write some of the appurtenances required for the pipes of water distribution networks.

15. Explain about the analysis of distribution networks in water distribution and supply to buildings.

16. Write short notes on the detection and prevention of wastage of water.

SECTION-B

CHAPTER-VI

1. Describe the steps involved in the design of septic tank. And also explain the working of a septic tank with neat sketch.

2. What is meant by sedimentation tank and explain its types with neat sketch.

3. i. Write the design criteria for a grit chamber and brief its construction and functioning. ii. Describe the working of grit chamber and its types.

4. i) Show the design a bar screen for a peak average flow of 30 million lit per day. ii) Show the 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

5. i) Briefly describe the objectives, operations and maintenance issues pertaining to primary treatment of sewage.

ii) Describe in detail about grey water harvesting and its methods.

6. i)Summarize the role of Screen Chamber in Sewage treatment plant and write its design procedure
ii) Estiamte the settling velocity of spherical particle of specific gravity 2.65 and diameter 0.18mm. Take kinematic viscosity of water as $1.016 \times 10 - 2$ m/s.

7. i) Discuss in brief the various types of settling and design considerations of sedimentation tanks. ii) Design a rectangular sedimentation tank for treating

12MLD adopting L:B ratio as 2.5 and overflow rate 40m3/m2/day. Assume Detention Time as 2 hours

8. Show the design a circular primary sedimentation tank to treat an average sewage flow of 5000 m3/day, suitably assuming the design criteria. Draw a neat sketch of the designed tank.

9. Show the design a screen and grit chamber for a proposed sewage treatment plant (STP) of 60 MLD.

10. 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 v. Design a dispersion trench adopting infiltration rate as 1200 lit/m2day

11. i. Classify the types of screens adopted in sewage treatment with neat sketch. ii. Classify the different methods of dispersion trenches in a septic tank with neat sketch.

12. Investigate the various types of settling and discuss the significance of surface overflow rate in the design of sedimentation tanks.

13. Design a primary settling tank unit for a peak flow of 40 MLD in a sewage treatment plant.

14. 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.

15. 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.

16. Discuss the operation and maintenance of sewage treatment plant.

17. Explain in detail about the on-site sanitation and its methods Application Show how it is followed in India and other countries.

18. 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 to be 1250 l/m3/d.

CHAPTER-VII

1. Examine the components and the operational principles of activated sludge process with neat sketch. Write its advantages and disadvantages

2. Label with neat flow diagram and explain ASP in treating waste water. Discuss the various design parameters involved in it.

3. i) Show the loading refers criteria of aeration tank of an activated sludge process ii) Describe the operational problem of activated sludge process and give the remedial suggestions

4. 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 6m3/m2/d and organic loading of 0.35kg/m3/d ii) List in detail about the operational problem of standard rate trickling filters and list out their remedies

5. Summarize in detail with neat sketches about the trickling filters and state the various advantages and disadvantages of conventional trickling filter.

6. 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.

7. Discuss about the working principle of oxidation ditch with advantages and disadvantages and draw the typical process flow diagram.

8. Calculate and design an oxidation ditch for a design sewage flow of 50MLD. Assume suitable data wherever necessary. Show the neat sketch of the designed unit.

9. i) Explain the Reclamation and Reuse of Sewage ii) Explain in detail about waste stabilization pond, its classification and its working principle.

10. Illustrate about waste stabilization ponds? Explain the working principle of aerobic stabilization pond.

11. i) Explain the algal-bacterial symbiosis with respect to waste stabilization pond ii) Design a high rate trickling filter for treating sewage of 22 ML/d with a raw sewage BOD5 of 320 mg/L. Assume a recirculation ratio of 1.5 and efficiency of the PST as 35% and filter as 75%. Use NRC equation

12. Design an oxidation ditch for a community of 7500 with per capita sewage contribution of 90 Lpcd and BOD 250 mg/l, the desired BOD of the treated sewage is 30mg/l.

13. Summarize the working condition of Oxidation pond and reverse osmosis with reference to their principle, efficiency, advantages and disadvantages.

14. Examine and design a single stage trickling filter to yield an effluent BOD5 of 30 mg/l. The influent BOD following primary clarification is 175 mg/l and the flow is 15000 m3/d. Maintain a hydraulic loading rate of 20 m3/m2/d and a filter depth of 2 m. Assume a recirculation ratio of 1.5.

15. 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.

16. Describe with neat sketches about the typical process flow diagram of an oxidation ditch and explain its working principle.

17. Calculate the surface area of a low rate trickling filter to treat 10 MLD of average sewage flow with a BOD of 300 mg/l at an organic loading rate of 0.2 kg BOD/m3/day

18. Discover how UASB is related with treatment of waste water? Write in detail about the UASB reactor with neat sketch, advantages and disadvantages. Explain its function and operation.

CHAPTER-VIII & IX

1. A large stream has a rate of re-aeration constant, Kr = 0.24 per day (to base 10) and de-oxygenation constant, Kd = 0.1 per day (to the base 10).The initial deficit of the mixture of stream and waste water at the point of reference Do = 4 mg/l and the ultimate 5 day BOD, Lo = 35mg/l. Find the D.O deficit and critical time.

2. Name the various actions involved in the self-purification process of a stream and explain them briefly.

3. In Indian towns and cities, the land disposal method is mostly preferred. Why?

4. i) Draw a typical oxygen sag curve and explain its meaning and state its importance 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 m3/s into a river having a flow of 30m3/s and no BOD.

5. Explain the various zones of pollution in river stream.

6. Explain briefly about the methods of sewage disposal.

7. What is sewage farming? What are its advantages over the method of disposal of sewage by dilution?

8. Discuss briefly about the disposal of sewage in sea water.

9. Justify under which conditions, the effluent irrigation method for disposal of sewage can be adopted.

13. Write short notes on soil dispersion system. BT-1 Remember 11. How will you apply sewage effluents to farms and explain their methods in detail.

12. What is meant by sewage sickness and list out the preventive measure to control it?

13. Which method of sewage disposal is safe and best? Justify your answer.

14. 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.

15. Summarise the principle of the self-purification process of river and the various stages of oxygen sag curve.

16. 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 (KD) as 0.1

17. Derive Streeter Phelps Equation.

18. What are the environmental and health risks associated with sewage farming?

CHAPTER-X &XI

1. Explain in detail about the factors affecting sludge digestion.

2. Design a sludge digestion tank with the following data. 1. Average flow of sewage = 60 MLD 2. Total Suspended Solids in raw sewage = 350 mg/L 3. Volatile Suspended solids = 250 mg/L 4. Moisture content of the digested sludge = 87% Assume 65% of removal in done in primary setting tank and fresh sludge has water content of 95%.

3. Describe briefly about the sludge digestion tank with a neat sketch.

4. Discuss the need for sludge dewatering and explain the various sludge dewatering methods.

5. Discuss about the recent advances in sludge treatment.

6. Secondary sedimentation tank of a waste water treatment plant produces 1100kg (dry basis) solids with moisture content of 95%.Solids are of 70% volatile with specific gravity of 1.05 and 30% being fixed with specific gravity of 2. Determine the sludge volume as it is produced and after the incineration.

7. Explain the anaerobic sludge digestion process and also the effects of pH and temperature on it.

8. Explain in detail about gravity thickening.

9. A waste water treatment plant produces sludge of 1000 kg 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.

10. Explain with neat sketch of a high rate two stage anaerobic sludge digester and explain its salient features.

11. Describe the mechanism of biogas recovery from sludge.

12. Design sludge drying beds to dewater the digested sludge produced from wastewater treatment plant based on Activated Sludge Process designed for 5000 population. Assume dry solid concentration and dry solid loading rate as 70 g/capita/day and 100 kg/m2/day. Take 7% solid content in digested sludge and specific gravity of digested sludge as 1.02.

13. Explain in detail about sludge drying beds.

14. Describe briefly the heat treatment method of sludge conditioning.

15. Explain in detail about sludge disposal.

16. Design a sludge digestion tank for 40,000 people. The sludge content per capita per day is 0.068 kg. The moisture of the sludge is 94%. The Specific Gravity of the wet sludge is 1.02 and 3.5 percent of the digestor volume is daily filled with the fresh sludge, which is mixed with the digested sludge.

17. What parameters you will consider while designing sludge digestion tank?

18. Explain in detail about sludge conditioning and dewatering with a neat sketch.