VALLIAMMAI ENGINEERING COLLEGE

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF CIVIL ENGINEERING

QUESTION BANK

VI SEMESTER

CE6605 -ENVIRONMENTAL ENGINEERING - II

Regulation – 2013

Academic Year 2017 – 18

Prepared by

Ms.S.K.Divya, Assistant Professor/Civil

Dr.D.Elango, Professor& HOD/Civil

Ms.S.MohanaSundari, Assistant Professor/Civil

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SUBJECT : CE6605 / ENVIRONMENTAL ENGINEERING - II

SEM / YEAR: VI/III

UNIT I - PLANNING FOR SEWAREGE SYSTEM

Sources of wastewater generation – Effects – Estimation of sanitary sewage flow – Estimation of storm runoff – Factors affecting Characteristics and composition of sewage and their significance – Effluent standards – Legislation requirements.

PART – A

Q. No	Questions	BT Level	Competence
1.	Describe the meaning and significance of time of Concentration.	BT-1	Remember
2.	List the five parameters of effluent standards for sewage disposal into inland surface water bodies recommended by the pollution control board.	BT-1	Remember
3.	Name the sewage characteristics with which organic matter concentration is expressed.	BT-1	Remember
4.	List the factors influencing the fixing of Design period.	BT-1	Remember
5.	Examine the necessity of legal requirements and effluents disposal of sewage.	BT-1	Remember
6.	Identify the significance of BOD/COD ratio.	BT-1	Remember
7.	Differentiate between dry weather flow and wet weather flow.	BT-2	Understand
8.	Discuss the various sources of waste water	BT-2	Understand
9.	Discuss how do you estimate storm run-off?	BT-2	Understand
10.	Differentiate unit operations and unit processes.	BT-2	Understand
11.	Examine the impacts of nutrients on water bodies?	BT-3	Application
12.	Show the effect of oxygen demanding waste water on water bodies?	BT-3	Application
13.	Show the various factors for fixing the design period?	BT-3	Application
14.	Explain the necessity of wastewater characterization.	BT-4	Analyse
15.	Why do the analyze BOD and COD usually give different results for the same wastewater?	BT-4	Analyse
16.	Explain the effect of suspended solids on water bodies?	BT-4	Analyse

17.	Generalize the typical characteristics of sewage from South Indian Cities.	BT-5	Evaluate
18.	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-5	Evaluate
19.	Summarize about sewerage system and mention the types of sewerage system.	BT-6	Create
20.	Explain the pollution control board norms for effluent discharge into streams.	BT-6	Create

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	Remember
2.	(i) List out the factors influencing the dry weather flow and explain it in detail. (6) (ii) How will you estimate storm water flow? Discuss the factors influencing the storm water flow. (7)	BT-1	Remember
3.	(i) B.O.D. of a sewage incubated for one day at 30°C has been found to be 120 mg/l. What will be its 5 day 20°C BOD, if K at 30°C is 0.16 per day (base 10). (9) (ii) What is population equivalent? State its uses. (4)	BT-1	Remember
4.	(i) Name the various effluent standards for waste water disposal into inland water bodies and ocean. (7) (ii) List the effects of sewage on environment. (6)	BT-1	Remember
5.	(i) Discuss the significance of total solids and BOD in determining the characteristics of sewage. (5) (ii) 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. (8)	BT-2	Understand
6.	Discuss about the information to be collected while planning for sewerage systems. How will you use the corrected information?	BT-2	Understand
7.	Discuss the Legislation requirements and standards for sewage	BT-2	Understand

<table>
<tr><td></td><td>treatment.</td><td></td><td></td></tr>
<tr><td>8.</td><td>Calculate the combined flow discharge of sewage for the given data. Area to be served is 150 hectares. Population density is 50000. 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.</td><td>BT-3</td><td>Application</td></tr>
<tr><td>9.</td><td>Calculate the storm run-off from 10 hectares of a surface having the following characteristics if the maximum rain intensity in the area is 5 cm/hr.
<table>
<tr><th>Nature of surface</th><th>Roof</th><th>Pavement</th><th>Paved yards</th><th>Macadam roads</th><th>Lawns and gardens</th><th>Thick vegetation</th></tr>
<tr><td>Areal distribution (% of total)</td><td>30</td><td>10</td><td>5</td><td>25</td><td>25</td><td>5</td></tr>
<tr><td>Coefficient of run-off</td><td>0.9</td><td>0.85</td><td>0.80</td><td>0.40</td><td>0.1</td><td>0.05</td></tr>
</table></td><td>BT-3</td><td>Application</td></tr>
<tr><td>10.</td><td>(i) Explain the terms BOD and COD. Differentiate between first and second stage BOD. (6)
(ii) The BOD of a sewage incubated for one day at 30^{o}c has been found to be 120mg/l. Identify the 5-day BOD at 20^{o}C. Assume BOD rate constant K = 0.21 (base e) per day at 20^{o}c and temperature correction coefficient $\theta = 1.056$. (7)</td><td>BT-4</td><td>Analyse</td></tr>
<tr><td>11.</td><td>Explain the sewage flow fluctuations and discuss the importance of studying them.</td><td>BT-4</td><td>Analyse</td></tr>
<tr><td>12.</td><td>(i) Explain the factors influencing sanitary sewage flow and its estimation. (6)
(ii) State the classification of solids present in sewage and the removal methods of each. (7)</td><td>BT-4</td><td>Analyse</td></tr>
<tr><td>13.</td><td>(i) Generalize how will you estimate the relative stability of sewage? (6)</td><td>BT-5</td><td>Evaluate</td></tr>
</table>

	(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)		
14.	Summarize the first stage BOD equation and ultimate BOD.	BT-6	Create

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	Understand

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

2.	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. (7) 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: a. Rate of Water supply = 200 LPCD b. Average runoff coefficient for the entire area = 0.5 c. Time of concentration = 50 min d. Assume 75% of water supplied reaches the sewer. (8)	BT-3	Application
3.	Explain the various physic-chemical characteristics of sewage and state their environmental significance.	BT-4	Analyse
4.	Summarize the detailed procedure to quantify sanitary sewage flow and storm water runoff with reference to an urban area.	BT-6	Create

UNIT II - SEWER DESIGN

Sewerage – Hydraulics of flow in sewers – Objectives – Design period - Design of sanitary and storm sewers – Small bore systems - Computer applications – Laying, joining & testing of sewers – appurtenances – Pumps – selection of pumps and pipe Drainage -. Plumbing System for Buildings – One pipe and two pipe system.

PART – A

Q. No	Questions	BT Level	Competence
1.	Define sewerage system. List out the components of it.	BT-1	Remember
2.	When does it become necessary to provide manhole in sewerage systems?	BT-1	Remember
3.	A sewer has to be designed considering both minimum velocity and maximum velocity of flows-State true or false and justify the answer.	BT-5	Evaluate
4.	Compare Self Cleaning velocity and Non-scouring velocity.	BT-6	Create
5.	Examine when does it become necessary to provide manhole in sewerage system?	BT-4	Analyse
6.	What do you mean by small bore system?	BT-1	Remember
7.	What is the significance of self-cleaning velocity in sewer design?	BT-1	Remember
8.	Name the two software's used in sewer design.	BT-1	Remember
9.	Discuss the advantages of using a circular section for sewers?	BT-2	Understand
10.	Differentiate between sanitary sewer and storm sewer.	BT-2	Understand
11.	Show the advantages of egg-shaped sewer sections.	BT-3	Application
12.	What do you understand by sewer appurtenances? Identify various appurtenances commonly used.	BT-4	Analyse
13.	Discuss the various steps involved in the layout and construction of sewers.	BT-2	Understand
14.	Show how to design the capacity of wet well in a sewage pumping station?	BT-3	Application
15.	Summarize about trap? State its quality requirements.	BT-6	Create
16.	Explain the objectives of screen chamber.	BT-4	Analyse
17.	Reciprocating pumps is not widely in the sewage pumping-state true or false and justify your answer.	BT-5	Evaluate

18.	Classify the different types of pumps used for pumping the sewage.	BT-3	Application
19.	How will you examine situations where the pumping of sewage becomes essential in sewage management?	BT-1	Remember
20.	Differentiate between one pipe and two pipe system.	BT-2	Understand
	PART– B		
1.	Enumerate and explain the various sewer appurtenances with neat sketches.	BT-1	Remember
2.	Classify the shapes of sewer pipes. Explain it in detail.	BT-3	Application
3.	Calculate the diameter of a separate sewer section running half full at maximum discharge for a town with a population of 100000. Water is supplied at a rate of 200 LPCD. Assume 80% of water supply turns as sewage. Take peak factor = 2.25 and n = 0.013 at all depth. Permissible slope is 1 in 600.	BT-3	Application
4.	Design a sewer to carry 17.5 lps of ultimate peak sewage flow at half full depth .Take the slope of the sewer as 1 in 400 and n=0.013. Check for self-cleaning velocity.	BT-4	Analyse
5.	A town has a population of 100000 persons with a per capita water supply of 200 Lpcd. Design a sewer running 0.7 times full. Take n=0.013 and slope 1 in 500 and a peak factor of 3. Assume 85% of water supply turns into sewer.	BT-5	Evaluate
6.	Design a sewer running 0.7 times full at maximum discharge condition for serving a town with a population of 90000 and provided with a water supply at 200litres/capita /day. Take slope as1 in 400. Manning's constant N=0.013, peak factor as band sewage flow rate as 85% of water supplied.	BT-4	Analyse
7.	The main combined sewer is to be designed to serve an area of 12 km^2 with a population density of 250 person per hectare. The average rate of flow is 250 LPCD. The maximum flow is 100% in excess of average together with the rainfall equivalent of 15 min in 24 hours, all of which are runoff. Determine the capacity of the sewer. Taking maximum velocity of flow 3 m/s, also	BT-1	Remember

	determine the size of the sewer.		
8.	Determine the diameter and slope of a sewer (n=0.013) carrying 0.0125 m^3/sec of peak sewage flow at half full depth.	BT-2	Understand
9.	How computer applications can be used in the sewer design.	BT-1	Remember
10.	Write down the procedure for laying and testing of sewer lines with neat diagram.	BT-3	Application
11.	i) What is the need for ventilation in sewage pumping station? How is it provided? (5) ii) Explain the configuration of manhole with a neat sketch. (8)	BT-1	Remember
12.	Describe about the various types of pumps used for lifting the sewage.	BT-2	Understand
13.	i) Explain the laying of sewers in the field for the designed alignment and gradient. (7) ii) Describe the one pipe and two pipe plumbing systems. Compare them. (6)	BT-2	Understand
14.	i) Under what circumstances pumping of sewage is needed. Enumerate the problems faced during pumping of sewage. ii) Explain the function of wet well in sewage pumping station	BT-6	Create
	PART - C		
1.	Design a sanitary sewer to serve a population of 5000 with per capita water supply rate of 110 lpcd . Assume n=0.013.	BT-3	Application
2.	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-3	Application
3.	i) Discuss the choice available and the factors to be considered while selecting pumps and pipes for sewerage system and explain. (7) ii) With help of neat sketch explain the location and functions of drop manhole 'inverted siphon'. (8)	BT-2	Understand
4.	What are the systems of plumbing? With help of a neat sketch discuss various systems of plumbing used for drainage. Discuss about its advantages and disadvantages	BT-1	Remember

UNIT III - PRIMARY TREATMENT OF SEWAGE

Objective – Selection of treatment processes – Principles, Functions, Design and Drawing of Units - Onsite sanitation - Septic tank with dispersion - Grey water harvesting – Primary treatment – Principles, functions design and drawing of screen, grit chambers and primary sedimentation tanks – Construction, operation and Maintenance aspects.

PART – A

Q. No	Questions	BT Level	Competence
1.	Quote the objectives of preliminary treatment of sewage.	BT-1	Remember
2.	What is meant by detritus tank?	BT-1	Remember
3.	What is the function of primary settling?	BT-1	Remember
4.	Define on-site sanitation .What are the methods of onsite sanitation ?	BT-1	Remember
5.	What is meant by septic tank? Show the different methods of dispersion trenches in septic tank.	BT-1	Remember
6.	Examine the purpose of using the skimming tanks in treatment systems.	BT-1	Remember
7.	Differentiate between unit operations and unit processes in wastewater treatment. Give at least two examples in each.	BT-2	Understand
8.	Discuss hydraulic subsidence value.	BT-2	Understand
9.	Discuss the biological concept taking place in septic tank.	BT-2	Understand
10.	Distinguish the grit chamber with Plain Sedimentation tank.	BT-2	Understand
11.	Examine how the velocity control device is necessary in grit chamber. Name the devices used.	BT-3	Application
12.	Show the Stoke's equation for discrete particle settling.	BT-3	Application
13.	If a circular sedimentation tank of diameter 35m treats 20 million litres of sewage daily, Calculate the applicable surface loading rate?	BT-3	Application
14.	Compare coagulation and Flocculation?	BT-4	Analyse
15.	State the objectives of grit removal.	BT-4	Analyse
16.	Identify the significance of Weir loading rate in Sedimentation tank unit?	BT-4	Analyse
17.	Explain about grit chamber and their design criteria.	BT-5	Evaluate

18.	Generalize about grey water and grey water harvesting?	BT-5	Evaluate
19.	Explain sedimentation?	BT-6	Create
20.	Construct the design criteria for screen chamber.	BT-6	Create
	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	Remember
2.	i) What is meant by sedimentation tank in a treatment system? (6) ii) Write in detail about the various types of sedimentation tank with neat sketches. (7)	BT-1	Remember
3.	i) Write the design criteria for a grit chamber and brief its construction and functioning. . (6) ii) Describe the working of grit chamber and its types. (7)	BT-1	Remember
4.	i) Show the design a bar screen for a peak average flow of 30 million lit per day. (6) 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. (7)	BT-1	Remember
5.	i) Briefly describe the objectives, operations and maintenance issues pertaining to primary treatment of sewage. (7) ii) Describe in detail about grey water harvesting and its methods. (6)	BT-2	Understand
6.	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	Understand
7.	i) Discuss in brief 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-2	Understand

8.	Show the design a circular primary sedimentation tank to treat an average sewage flow of 5000 m^3/day, suitably assuming the design criteria. Draw a neat sketch of the designed tank.	BT-3	Application
9.	Show the design a screen and grit chamber for a proposed sewage treatment plant (STP) of 60 MLD.	BT-3	Application
10.	Examine and design a septic tank for the following data:- a. No of persons = 140 b. Sewage contribution = 120 LPCD c. Desludging period = 1 year d. Length : Breadth ratio = 1 :2.5 e. Design a dispersion trench adopting infiltration rate as 1200 lit/m^2day	BT-4	Analyse
11.	i. Classify the types of screens adopted in sewage treatment with neat sketch. (6) ii. Classify the different methods of dispersion trenches in a septic tank with neat sketch. (7)	BT-4	Analyse
12.	Investigate the various types of settling and discuss the significance of surface overflow rate in the design of sedimentation tanks.	BT-4	Analyse
13.	Design a primary settling tank unit for a peak flow of 40 MLD in a sewage treatment plant.	BT-5	Evaluate
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.	BT-6	Create

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-1	Remember
2.	Discuss the operation and maintenance of sewage treatment plant.	BT-2	Understand
3.	Explain in detail about the on-site sanitation and its methods Show how it is followed in India and other countries.	BT-3	Application

4.	Design a septic tank for a hostel of 150 persons. Let the desludging period be taken as one year and length to breadth ratio as 2.5:1. Adopt peak discharge of 205 LPM, surface area at 0.92 m^2 for every 10 LPM of peak flow rate. Also design a soil absorption system dispersion trench for the disposal of the septic tank effluent, assuming the percolation rate as 100 $L/m^2/d$. Assume data wherever necessary.	BT-5	Evaluate

UNIT IV - SECONDARY TREATMENT OF SEWAGE

Objective – Selection of Treatment Methods – Principles, Functions, Design and Drawing of Units - Activated Sludge Process and Trickling filter – Oxidation ditches, UASB – Waste Stabilization Ponds – Reclamation and Reuse of sewage - sewage recycle in residential complex - Recent Advances in Sewage Treatment – Construction and Operation & Maintenance of Sewage Treatment Plants.

PART – A

Q.No	Questions	BT Level	Competence
1.	List the objectives of Secondary and Tertiary treatment of sewage.	BT-1	Remember
2.	Define sludge solids retention time in ASP design.	BT-1	Remember
3.	Identify the modified forms of conventional ASP.	BT-1	Remember
4.	Quote the functions of aeration in Activated Sludge Process?	BT-1	Remember
5.	When will you prefer the anaerobic treatment of sewage over an aerobic process?	BT-1	Remember
6.	Describe with few words about the sludge volume index.	BT-1	Remember
7.	Discuss the term re-circulation ratio in trickling filter. Write the formula for recirculation factor.	BT-2	Understand
8.	Distinguish between suspended growth processes and attached growth processes with suitable examples.	BT-2	Understand
9.	Illustrate how advanced treatment of sewage is different from conventional treatment system.	BT-3	Application
10.	Classify trickling filter and state its types? And how it will be used in treatment system?	BT-3	Application

11.	Examine hydraulic loading rate of a trickling filter?	BT-3	Application
12.	Explain UASB reactor? State the advantage of it.	BT-4	Analyse
13.	Compare the oxidation ditch with oxidation pond.	BT-4	Analyse
14.	Integrate Waste stabilization ponds are applicable for sewage management in rural areas only. Comment on this statement and justify your comment.	BT-5	Evaluate
15.	Distinguish between HRT and SRT.	BT-2	Understand
16.	Generalize about MLVSS and F/M ratio?	BT-5	Evaluate
17.	Differentiate between aerobic pond and anaerobic pond.	BT-2	Understand
18.	Summarize about sludge recycle.	BT-6	Create
19.	Explain how do you determine organic loading rate of a trickling filter?	BT-4	Analyse
20.	Compare activated sludge process and trickling filter process of sewage treatment.	BT-6	Create

PART - B

1.	Examine the components and the operational principles of activated sludge process with neat sketch. Write its advantages and disadvantages	BT-1	Remember
2.	Label with neat flow diagram and explain ASP in treating waste water. Discuss the various design parameters involved in it.	BT-1	Remember
3.	i) Show the loading refers criteria of aeration tank of an activated sludge process. (6) ii) Describe the operational problem of activated sludge process and give the remedial suggestions (7)	BT-1	Remember
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 $6m^3/m^2/d$ and organic loading of $0.35kg/m^3/d$. (7) ii) List in detail about the operational problem of standard rate trickling filters and list out their remedies. (6)	BT-1	Remember
5.	Summarize in detail with neat sketches about the trickling filters and state the various advantages and disadvantages of	BT-2	Understand

	conventional trickling filter.		
6.	Estimate the size of a high rate trickling filter for the following data: a. Recirculation ratio = 1.5 b. BOD of Raw sewage = 230 mg/l c. BOD removal in PST = 30% d. BOD of treated effluent required = 25 mg/l. e. Sewage flow = 4.5 MLD	BT-2	Understand
7.	Discuss about the working principle of oxidation ditch with advantages and disadvantages and draw the typical process flow diagram.	BT-2	Understand
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.	BT-3	Application
9.	i) Explain the Reclamation and Reuse of Sewage. (6) ii) Explain in detail about waste stabilization pond, its classification and its working principle. (7)	BT-4	Analyse
10.	Illustrate about waste stabilization ponds? Explain the working principle of aerobic stabilization pond.	BT-3	Application
11.	i) Explain the algal-bacterial symbiosis with respect to waste stabilization pond. (6) ii) Design a high rate trickling filter for treating sewage of 22 ML/d with a raw sewage BOD_5 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. (7)	BT-4	Analyse
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.	BT-5	Evaluate
13.	Summarize the working condition of Oxidation pond and reverse osmosis with reference to their principle, efficiency, advantages and disadvantages.	BT-6	Create
14.	Examine and design a single stage trickling filter to yield an effluent BOD_5 of 30 mg/l. The influent BOD following primary clarification is 175 mg/l and the flow is 15000	BT-3	Application

	m^3/d. Maintain a hydraulic loading rate of 20 $m^3/m^{2/}$d and a filter depth of 2 m. Assume a recirculation ratio of 1.5.		

PART - C

1.	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-5	Application
2.	Describe with neat sketches about the typical process flow diagram of an oxidation ditch and explain its working principle.	BT-2	Understand
3.	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/m^3/day	BT-3	Application
4.	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.	BT-3	Application

UNIT V - DISPOSAL OF SEWAGE AND SLUDGE MANAGEMENT

Standards for Disposal - Methods – dilution – Self purification of surface water bodies – Oxygen sag curve – Land disposal – Sludge characterization – Thickening – Sludge digestion – Biogas recovery – Sludge Conditioning and Dewatering – disposal – Advances in Sludge Treatment and disposal.

PART – A

Q.No	Questions	BT Level	Competence
1.	List the different unit processes involved in sludge treatment.	BT-1	Remember
2.	Define sewage sickness and state the preventive methods for sewage sickness.	BT-1	Remember
3.	Define dilution factor.	BT-1	Remember
4.	Summarize the objectives of sludge thickening and its method.	BT-2	Understand
5.	Describe the methods of disposal of sewage by land treatment.	BT-2	Understand

6.	Illustrate the term self-purification.	BT-3	Application
7.	Classify the various zones of a polluted river.	BT-3	Application
8.	Explain 'Oxygen Sag Curve' and what is its significance..	BT-4	Analyse
9.	Compose what are the concerns in the application of sewage on to land?	BT-5	Evaluate
10.	Explain sludge conditioning and its methods.	BT-4	Analyse
11.	Draw the oxygen sag curve and show the de-oxygenation and re-oxygenation curve.	BT-6	Create
12.	Classify the various methods of sewage disposal	BT-4	Analyse
13.	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-5	Evaluate
14.	Differentiate between sewage farming and ripened sludge.	BT-2	Understand
15.	Examine the need for sludge digestion?	BT-1	Remember
16.	Discuss the significance of pH in an anaerobic digestion?	BT-2	Understand
17.	Examine the various methods of sludge dewatering.	BT-1	Remember
18.	List out the common methods of sludge disposal.	BT-1	Remember
19.	Examine how does one improve the dewatering ability of sludge?	BT-3	Application
20.	Summarize the name the feed material sources for biogas recovery in a sewage treatment plant.	BT-6	Create
	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	Remember
2.	Name the various actions involved in the self-purification process of a stream and explain them briefly.	BT-1	Remember
3.	A waste water treatment plant produces sludge of 1000kg dry solids per day with a moisture content of 97%. The solids are	BT-2	Understand

	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.		
4.	Discuss the need for sludge dewatering and explain the various sludge dewatering methods.	BT-2	Understand
5.	Solve the Streeter Phelps equation and show its application.	BT-3	Application
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 2.6. Determine the sludge volume as it is produced and after the incineration.	BT-4	Analyse
7.	i) Explain the anaerobic sludge digestion process and also the effects of pH and temperature on it. (7) ii) State the Indian standards for sewage disposal on land and conditions favoring it. (6)	BT-5	Evaluate
8.	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- 6	Create
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.	BT-3	Application
10.	Explain with neat sketch of a high rate two stage anaerobic sludge digester and explain its salient features.	BT-4	Analyse
11.	Describe the mechanism of biogas recovery from sludge.	BT-2	Understand
12.	The thickened sludge of 70 m^3/d is processed in a standard rate anaerobic digester. The moisture content of the thickened sludge is 95%. The digestion period is 25 days and the sludge must be stored for 3 months between final disposal events. The organic content of the sludge is 75% and 65% of the organic	BT-4	Analyse

	are converted into gaseous and liquid end products. The solid content of the digested sludge is 45%. Determine the required reactor volume.		
13.	What is sewage farming? List the methods and state its advantages over the method of disposal of sewage dilution.	BT-1	Remember
14.	(i) What is land treatment? Discuss the conditions under which it is suitable. (7) (ii) Describe briefly the heat treatment method of sludge conditioning. (6)	BT-1	Remember
	PART-C		
1.	Explain in detail about (i) Wastewater reclamation (8) (ii) Sewage disposal to sea water (7)	BT-4	Analyse
2.	Summarize the principle of the self-purification process of river and the various stages of oxygen sag curve.	BT- 6	Create
3.	Illustrate with the help of flow chart, Explain various process involved in the sludge treatment and disposal. Explain the mechanism of anaerobic and aerobic sludge digestion with their relative merits and demerits.	BT-3	Application
4.	(i) Explain briefly about the characteristics of sludge. (6) (ii)A town discharges 14 million litres per day sewage at a temperature of 23°C into a river having flow of 1.7 m^3/sec and water temperature of 20°C. BOD at 20°C for the waste water is 160 mg/l and k (base 10) is 0.1 per day. If R is 0.2 per day what is the critical oxygen deficit and the distance at which it occurs. Assume the stream as 92% saturated with oxygen before sewage addition the solubility of oxygen at 20°C as 9.0 mg/l and river flow velocity as 0.12 m/s. (9)	BT-4	Analyse

BT – ALLOTMENT

S.No	Subject		BT1	BT2	BT3	BT4	BT5	BT6	Total Question
1	Unit-1	Part-A	6	4	3	3	2	2	20
		Part-B	4	3	2	3	1	1	14
		Part-C	-	1	1	1	-	1	4
2	Unit-2	Part-A	6	4	3	3	2	2	20
		Part-B	4	3	3	2	1	1	14
		Part-C	1	1	2	-	-	-	4
3	Unit-3	Part-A	6	4	3	3	2	2	20
		Part-B	4	3	2	3	1	1	14
		Part-C	1	1	1	-	1	-	4
4	Unit-4	Part-A	6	4	3	3	2	2	20
		Part-B	4	3	3	2	1	1	14
		Part-C	-	1	2	-	1	-	4
5	Unit-5	Part-A	6	4	3	3	2	2	20
		Part-B	4	3	2	3	1	1	14
		Part-C	-	-	1	2	-	1	4

TOTAL NUMBER OF QUESTIONS

PART-A	100
PART-B	70
PART-C	20
TOTAL	190