Total No. of Questions : 12]

SEAT No. :

P1504

[Total No. of Pages :7

[4759]-1
B.E. (Civil Engineering)
ENVIRONMENTAL ENGINEERING - II
(2008 Course) (Semester - I)

Time : 3 Hours] *[Max. Marks :100*

Instructions to the candidates:

1) ***Solve Q.No.1 or 2, 3 or 4, 5 or 6 from section -I and Q.No. 7 or 8, 9 or 10, 11 or 12 from section - II.***
2) ***Answer to the two sections must be written in separate answer books.***
3) ***Figures to the right indicate full marks.***
4) ***Draw neat diagram wherever necessary.***
5) ***Use of logarithmic table, slide rule and electronic pocket calculator are allowed.***
6) ***Assume suitable data, if necessary, stating it clearly.***

SECTION - I

Q1) a) State various formulas used for computation of velocity of flow in sewer. Hence explain the significance of maximum and minimum velocities to be generated in the sewer with suitable examples. **[6]**

b) State the rational formula used for computation of storm water discharge. Hence determine the storm water discharge produced from a sewer district of 40 Hectors comprising different type of sub catchment as given below. The average intensity of rainfall in the area is 50mm/hour. **[6]**

Type of catchment	% of area	Coefficient of runoff
1. Built up area	30	0.95
2. Road surface	15	0.8
3. Open space	25	0.2
4. Lawns and gardens	40	0.15

c) What is DO fixation? Why it is necessary to fix DO during its measurement? **[4]**

OR

P.T.O.

Q2) a) Explain the variation in sewage flow. How the variation in sewage flow is taken into account while designing the sewer. **[4]**

b) List out various appurtenances used in sewerage system and hence explain the principle of working and need of oil & grease trap. **[4]**

c) Design a circular sewer for conveyance of sewage generated from a town with population of 1.2 lakh and rate of water supply of 150 L/C/D. The sewer should be designed to carry maximum discharge while running 0.7 times full. Also check the velocity at minimum flow, it should be more than 0.6 m/s. Use following data. **[8]**

i) Max.flow/Av.flow=3;

ii) Min.flow/Ave.flow=0.34;

iii) Manning's constant=0.013;

iv) Hydraulic elements at partial flow condition.

Proportionate depth (d/D)	Proportionate velocity (v/V)	Proportionate discharge (q/Q)
0.7	1.12	0.838
0.4	0.902	0.337
0.3	0.776	0.196
0.2	0.615	0.088
0.1	0.401	0.021

Q3) a) Explain Oxygen sag, Deoxygenation and Reoxygenation curves with help of neat diagram? **[4]**

b) Explain with neat sketch, the principle and working of grit chamber. Describe the method of disposal of grit? **[8]**

c) State the Streeter - Phelp's equation and explain each term in equation? **[4]**

OR

Q4) a) Explain different zones during self-purification of stream? **[8]**

b) Design the screen chamber to treat a Maximum flow of 60 mld of sewage? **[8]**

Q5) a) State various modifications in Activated Sludge Process and hence explain any two with reference to process details, HRT, SRT and BOD removal efficiency. **[9]**

b) Design a high rate single stage trickling filter for treating domestic sewage flow of 10MLD using N.R.C. formula. Use following data. **[9]**

i) BOD5 of raw sewage = 300 mg/L,

ii) BOD removed during primary treatment =30%,

iii) Organic loading rate = 0.8Kg/m^3/d,

iv) Hydraulic loading rate = 15m^3/m^3/d,

v) Recirculation ratio =2.

Determine,

1) Volume of filter media

2) Dimensions of trickling filter

3) Efficiency of trickling filter

OR

Q6) a) Draw a neat flow diagram of sewage treatment plant with trickling filter as method of secondary treatment. **[4]**

b) Explain the principle and working of trickling filter. **[4]**

c) Design a completely mixed activated sludge process for treating domestic sewage flow of 10MLD. Use following data. **[10]**

i) BOD5 of raw sewage = 300 mg/L,

ii) BOD removed during primary treatment = 30%.

iii) Permissible effluent BOD = 30mg/L.

iv) Permissible suspended solids in treated effluent = 30mg/L of which 65% is biodegradable.

v) MLSS = 3000mg/L,

vi) Return sludge solids concentration = 10000mg/l,

vii) Ratio of VSS/SS =0.8,

viii) Kinetic constants: Y = 0.5, Kd = 0.05.

ix) Oxygen transfer capacity for aerators under field condition = 1.6 Kg/d.

Determine,

1) Influent and effluent BOD

2) Volume of aeration tank

3) Oxygen and power requirement

4) Rate of sludge wasting and sludge recirculation ratio.

SECTION - II

Q7) a) Explain the symbiotic relationship between bacteria and algae in oxidation pond. **[4]**

b) Differentiate between oxidation pond and aerated lagoon with reference to organic loading, HRT, BOD removal efficiency and method of aeration. **[6]**

c) An aerated lagoon system is to be provided for treatment of sewage using following data: **[6]**

i) Sewage flow = 10MLD,

ii) Raw sewage BOD_5 = 240mg/L,

iii) Desired BOD5 of treated effluent = 30mg/L,

iv) Hydraulic residence time (HRT) = 06 day,

v) Growth constants = 0.5, Kd = 0.05.

vi) Oxygen transfer capacity for aerators under field condition 1.6 Kg/d.

Determine:

1) Volume and dimensions of aerated lagoon,

2) Volatile solids produced in the aerated lagoon,

3) Oxygen and power requirement.

OR

Q8) a) Differentiate between activated sludge process and aerated lagoon and comment on suitability of these processes for treatment of sewage. **[6]**

b) Explain the principle and working of facultative aerated lagoon. **[4]**

c) Design an oxidation pond for treatment of domestic sewage, using following data. **[6]**

i) Sewage flow = 2MLD,

ii) Raw sewage BOD_5 = 240mg/L,

iii) Desired BOD5 of treated effluent = 30mg/L,

iv) Average solar radiation = 150Cal/cm^2/d,

v) Efficiency of sunlight utilization by algae = 0.06,

vi) Unit heat of combustion for algae = 6000Cal/g,

vii) Depth of pond = 1m.

viii) BOD_5/BOD_L = 0.68.

Determine,

1) Area and dimensions of oxidation pond,

2) Organic loading in KgBOD/Ha/d.

3) Hydraulic residence time (HRT).

Q9) a) Design a septic tank for 200 users. Water allowance is 120 liters per head per day. Also design a suitable soil absorption system if the percolation rate is 3min/sec. and depth of ground water table below GL is 1.5 m. **[8]**

b) Write short note on Up-flow Aerobic Sludge Blanket Reactor (UASBR). **[5]**

c) Explain various method of sludge disposal along with merits and demerits. **[5]**

OR

Q10)a) Explain the aerobic sludge digestion process and also discuss the various design parameter of aerobic digester. **[8]**

b) Explain the method of disposal of septic tank effluent. **[5]**

c) What do you mean by sludge thickening? Explain the various method of sludge thickening. **[5]**

Q11) Write short note on: **[16]**

a) Equalization

b) Neutralization

c) Sludge drying bed

d) Discharge standard for disposal of treated effluent in river.

OR

Q12) Explain with a flow diagram for waste water treatment process of following industry. **[16]**

a) Sugar

b) Dairy

c) Textile

d) Distillery

EEE