

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-VI(NEW) – EXAMINATION – SUMMER 2019
Subject Code:2164010
Date:21/05/2019
Subject Name: Water and Wastewater Treatment Technologies
Time:10:30 AM TO 01:00 PM
Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

MARKS

- Q.1** (a) A town has an existing horizontal flow sedimentation tank with an overflow rate of $17 \text{ m}^3/\text{day}/\text{m}^2$, and it is desirable to remove particles that have settling velocity of $0.1 \text{ mm}/\text{sec}$. Assuming the tank is an ideal sedimentation tank, Find the percentage of particles removal. **03**
- (b) Ion concentrations obtained for a groundwater sample (having $\text{pH} = 8.1$) are given below: **04**

Ion	Ca^{2+}	Mg^{2+}	Na^{2+}	HCO_3^-	SO_4^{2-}	Cl^-
Ion concentration (mg/L)	100	6	15	250	45	39

Find the total hardness, carbonate and non-carbonate hardness in the above water sample.

- (c) The following data refers to an ASP: (i) sewage discharge = $3500 \text{ m}^3/\text{day}$ (ii) volume of tank 10900 m^3 (iii) Influent BOD = 250 PPM (iv) Effluent BOD = 20 PPM (v) MLSS = 2500 PPM (vi) Effluent suspended solids = 30 PPM (vii) Waste sludge suspended solids = 9700 PPM (viii) quantity of waste sludge = $220 \text{ m}^3/\text{day}$. Find (i) HRT (ii) F/M ratio (iii) Efficiency (iv) Residence time (v) SVI if settled volume is $150 \text{ mL}/\text{liter}$ (vi) sludge return ratio **07**
- Q.2** (a) Explain the process of determination of alkalinity of water sample? **03**
- (b) Write short notes on: (1) Hardness (2) Turbidity **04**
- (c) For a circular sewer and a rectangular sewer to be hydraulically equivalent, find the relation between the depths of the rectangular sewer. Take the width of the rectangular sewer as 1.5 times the depth and assume **07**

that only three sides of rectangular sewer are wetted.

OR

- (c) Calculate the diameter and discharge of a circular sewer laid at a slope of 1 in 500 when running half full, and with a velocity of 2 m/sec. Take $N = 0.012$ in Manning's formula. 07
- Q.3** (a) What is coagulation and flocculation? 03
(b) Describe in briefly the various types of coagulants available in market for treating the water. 04
(c) A water treatment plant treat 10 MLD of raw water, the dose of alum is 18 ppm. Find the quantity of alum per year. Total quantity of CO_2 gas produced per year. Total quantity of floc per year. Total quantity of hardness. 07

OR

- Q.3** (a) What is sedimentation? Explain the various types of sedimentation 03
(b) Write briefly the construction of slow sand filter with neat sketches. Explain the advantage and disadvantage of slow sand filter. 04
(c) A water treatment plant treats 10 MLD of raw water. The dose of alum is 30 ppm. The raw water consist of alkali equal to 5 ppm of calcium carbonate. Find: (i) Total quantity of alum required (ii) Total quantity of calcium carbonate required (iii) Extra quantity of calcium carbonate required to be added (iv) Extra quantity of quick lime required having impurity 85%. 07
- Q.4** (a) What do you mean by screening and aeration? 03
(b) Draw the flow chart of waste water treatment plant. 04
(c) The BOD of a sewage incubated for one day at 30°C has been found to 100 mg/L. What will be the 5 day 20°C BOD. Assume $K = 0.12$ (Base 10) at 20°C . 07

OR

- Q.4** (a) Define the following: BOD, COD and THOD. 03
(b) Differentiate between the slow sand filter and rapid sand filter. 04
(c) Calculate the diameter of a rectangular plain sedimentation tank to treat 12×10^6 lit/day. Assume a detention period of 6 hours and the velocity of flow as 20 cm per minute i.e. 3.33 mm per sec. 07
- Q.5** (a) Explain briefly: Oxidation pond and septic tank? 03

- (b) For a waste water sample, 5 day BOD at 20°C is 200 mg/L and is 67% of the ultimate. What will be 4 day BOD at 30°C? 04
- (c) Calculate the diameter required for single stage trickling filter which is to be effluent BOD of 20 mg/L when treating settled domestic sewage of BOD 120 mg/L. Waste water flow is 2200 m³/day and recirculation discharge is 4000 m³/day. Depth of tank is 1.5 m. 07

OR

- Q.5
- (a) Write short notes on: Activated sludge process and skimming tank 03
 - (b) Explain with neat sketch the construction and working principle of trickling filter. 04
 - (c) Population of town is 30,000. Domestic sewage produced is 120 lpcd having BOD of 200 mg/L. Industrial sewage produced is 3 X 10⁵ lit/day having BOD 800 mg/L. Design high rate single stage trickling filter with following data: 07
 - BOD removed in PST: 35%
 - Organic loading rate: 10,000 kg/Ha.m/day (excluding recirculation)
 - Hydraulic loading rate: 170 X 10⁶ lit/Ha/day (Including recirculation)
 - Recirculation ratio: 1Find the efficiency of trickling filter and effluent BOD.

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