

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-VII (NEW) EXAMINATION – WINTER 2018

Subject Code: 2171306
Date: 29/11/2018
Subject Name: Wastewater Engineering
Time: 10:30 AM TO 01:30 PM
Total Marks: 70
Instructions:

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

- Q.1** (a) Explain the importance of Equalization process in a wastewater treatment plant. 03
- (b) Explain the purpose of following unit operations/processes in a wastewater treatment plant : (i) Screening (ii) Suspended growth biological process (iii) Primary sedimentation (iv) Nitrification 04
- (c) Differentiate between domestic wastewater and industrial wastewater. 07
- Q.2** (a) Explain the terms : (i) SOR (ii) WOR (iii) Food to microbe ratio 03
- (b) Design an aerated grit chamber for an average flow of 8 MLD, 04
- (c) A coarse screen is inclined at angle of 60° to the horizontal. There are 25 numbers of rectangular bars having 20mm size (facing the flow) and a clear spacing of 25mm. Determine the head loss using Kirschner equation, when the bars are clean and approach velocity is 1 m/s. 07
- OR**
- (c) Find out the area of secondary clarifier to be used for ASP using following data, if the sludge has to be thickened to a concentration of 10,000 mg/L 07
- | | | | | | | | | | | | |
|-----------------------------------|-----------|-----|------|------|-----|-----|----|----|----|----|----|
| Kg/
m ³
ML
SS | 80 | 60 | 50 | 40 | 30 | 20 | 10 | 5 | 4 | 3 | 2 |
| Vel
ocit
y
m/d | 0.17
5 | 0.3 | 0.44 | 0.78 | 1.7 | 5.3 | 34 | 62 | 68 | 76 | 83 |
- Q.3** (a) Enlist and explain the operational problems of screens. 03
- (b) Write a short note on tube settlers. 04
- (c) Design a primary settling tank for a wastewater treatment plant having a flow rate of $0.5 \text{ m}^3/\text{s}$ assuming SOR value as $32.5 \text{ m}^3/\text{m}^2\text{-day}$. Check for WOR and detention time. 07
- OR**
- Q.3** (a) Draw a flow diagram for sewage treatment with suspended growth biological process. 03
- (b) Enlist the different types of mixers used in a wastewater treatment plant and explain any one. 04
- (c) Design a cylindrical flash mixing tank by determining the tank dimensions and required input power using following data : 07
- Design flow rate = $11.5 \times 10^3 \text{ m}^3/\text{d}$
 Rapid mix $t = 5 \text{ s}$
 Rapid mix $G = 600 \text{ s}^{-1}$
 $\mu = 1.519 \times 10^{-3} \text{ N/m}^2\text{-s}$

- Q.4 (a) Explain the operational problem of Bulking sludge, 03
 (b) Differentiate between diffused aeration and mechanical aeration 04
 (c) For a flow rate of $0.05657 \text{ m}^3/\text{s}$ and average BOD_5 concentration of 140 mg/L in primary treated effluent, find the volume of aeration tank for a complete mix ASP for following conditions : 07
 (1) The treated effluent should have 30 mg/L BOD and 30 mg/L SS
 (2) Assume BOD of SS = 33 % of SS
 (3) $K_s = 100 \text{ mg/L}$ BOD, $\mu_m = 2.5 \text{ d}^{-1}$, $Y = 0.5$, $k_d = 0.05 \text{ d}^{-1}$
 Also calculate HRT and F/M ratio.

OR

- Q.4 (a) What is Bio tower? Explain its working. 03
 (b) Write a short note on Sequencing Batch Reactor 04
 (c) Design a Rotating Biological Contactor to treat a flow of 50 MLD of primary treated wastewater having BOD_5 of 200 mg/L. Desired effluent BOD_5 is 30 mg/L. 07

- Q.5 (a) Prepare a list of sludge dewatering devices and explain any one along with a neat sketch. 07
 (b) Determine the dimensions of UASB reactor for wastewater having flow rate of $1500 \text{ m}^3/\text{d}$. The characteristics of wastewater are as under: 07
 $\text{BOD} = 300 \text{ mg/L}$
 $\text{COD} = 450 \text{ mg/L}$
 $\text{TSS} = 400 \text{ mg/L}$
 $\text{VSS} = 270 \text{ mg/L}$
 $\text{Sulphate} = 85 \text{ mg/L}$
 Assume required data.
 Also estimate the methane gas generation rate.

OR

- Q.5 (a) Differentiate between Standard rate and high rate digester. 03
 (b) Design an oil and grease trap to remove 170 mg/L of O& G for a flow of $45000 \text{ m}^3/\text{d}$ of domestic wastewater. 04
 (c) Find out the volume of equalization tank to get a constant out flow for the hourly flow rate variations as given in table below: 07

Time	0	1	2	3	4	5	6	7	8	9	10	11
Flow m^3/s	0.0875	0.07	0.0525	0.0414	0.0334	0.0318	0.0382	0.0653	0.113	0.131	0.135	0.137
Time	12	13	14	15	16	17	18	19	20	21	22	23
Flow m^3/s	0.135	0.129	0.123	0.111	0.103	0.104	0.105	0.116	0.127	0.128	0.12	0.110
