

GUJARAT TECHNOLOGICAL UNIVERSITY
ME - SEMESTER- 2 • EXAMINATION – WINTER - 2023

Subject Code:3721802**Date: 05 Jan 2024****Subject Name:Treatment Process Design & Drawing****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.

- Q.1 (a)** Write down the design criteria for design of Coarse screen **07**
- (b)** Design a circular sedimentation tank for a flow of 21000 m³/d. Assume detention time= 2 hours and SOR = 35 m³ / m² – d. Check for WOR and horizontal velocity. Also draw a neat sketch. **07**
- Q.2 (a)** Define the terms : (1) SOR (2) WOR (3) F/M ratio (4) Mean Cell residence Time (5) Recycle Ratio (6) Approach velocity (7) Scour Velocity **07**
- (b)** Design a grit chamber for a flow of 10 MLD. **07**
- OR**
- (b)** Design a coarse screen for a flow of 8 MLD **07**
- Q.3** An ASP has to be designed to meet an effluent standard of 25 mg/L BOD₅ and 30 mg/L SS. The primary treated wastewater has a flow rate of 0.03 m³/s and BOD₅ of 200mg/L. Using following assumptions calculate the volume of Aeration tank : **14**
- i. BOD₅ of effluent SS concentration is 70% of allowable SS concentration.
 - ii. MLVSS in reactor is 3000 mg/L and MLVSS in recycle sludge is 8,000 mg/L.
 - iii. Take K_s= 100 mg/L, k_d = 0.025d⁻¹, Y=0.8, k=12.5
- Also calculate sludge recycle ratio, sludge wastage rate, F/M ratio and HRT.
- OR**
- Q.3 (a)** A Rapid Sand Filter is to be designed to treat a flow of 40,000 m³/d. Find out : **07**
- (1) Number of beds (2) Dimensions of bed (3) Depth of sand and gravel bed.
- (b)** Write down the steps for design of underdrainage system of Rapid Sand Filter. **07**
- Q.4 (a)** The dimensions of a bag in a filter unit are 150 mm in diameter and 3.0 m long. Calculate the filtering area of the bag. The filtering unit consists of 40 such bags and is to treat 14000 m³/h of gas from furnace. Calculate the filtration velocity. Also calculate the mass of particles collected daily assuming that the inlet loading is 6.5 g/m³ and the unit operates at 99.99 % collection efficiency. **07**
- (b)** Design a venturi scrubber for a flow of 10,000 m³/hr with following data : L/G ratio = 2.5 L/m³, assume relative velocity between 30 to 120 m/s. Diameter of particle = 5µm. **07**

OR

- Q.4 (a)** Define the terms : (1) Cut size diameter (2) Air to cloth ratio (3) Can velocity (4) Saltation velocity (5) Pressure Drop (6) Liquid to gas ratio (7) Migration velocity **07**
- (b)** Write down the design criteria and design steps for cyclone separator. **07**
- Q.5 (a)** Design a clariflocculator to treat 5 MLD of water **14**

OR

- Q.5 (a)** The cumulative flow of wastewater at treatment plant in a day varies as shown in following table. Determine the volume in m^3 of equalization tank for given flow variations **07**

Time hr	0	2	4	6	8	10	12	14	16	18	20	22	24
Cumulative flow m^3	0	30	55	80	110	120	130	145	155	165	175	200	230

- (b)** Design tube settler module for design flow = 1 MLD **07**
