

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 7 – EXAMINATION – SUMMER 2026

Subject Code: 2171306

Date: 20/05/2026

Subject Name: Wastewater Engineering

Time: 02:30 PM TO 05:30 PM

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

- Q.1** (a) Compare domestic wastewater and municipal wastewater based on source and characteristics. 03
- (b) Explain treatment flow scheme for municipal wastewater. 04
- (c) Analyze operational problems of chemical coagulation process and suggest remedies. 07

- Q.2** (a) List any three features of industrial wastewater. 03
- (b) Estimate the headloss through a 2 m wide vertical bar screen with 78, 9.5 mm square edge bars, if the flow rate is 56750 m³/d and length of bar which is equal to depth of flow is 10 m. Assume that the approach velocity is zero and coefficient of discharge is 0.68. 04
- (c) Design a grit chamber for population 50,000 with water consumption of 135 LPCD. 07

OR

- (c) For the flow rate data given in the table below, find out the volume of equalization tank: 07

Time Period	8-11	11-14	14-17	17-20
Volume of W/W, m ³	22.3	43.2	16.8	41.1
Time Period	20-23	23-2	2-5	5-8
Volume of W/W, m ³	39.6	11.1	11.1	8.1

- Q.3** (a) Write down design criteria of Oil and Grease Trap, also draw a neat diagram of it. 03
- (b) Examine causes of poor floc formation in rapid mixer and flocculator. 04
- (c) Evaluate wastewater characteristics and recommend suitable treatment flow scheme for domestic sewage. 07

OR

- Q.3** (a) Explain the purpose of grit chamber in wastewater treatment plant. 03
- (b) Explain the concept of flocculation and enlist the different types of flocculators. 04

- (c) An activated sludge plant is to be designed for 10 MLD domestic wastewater flow to operate at 10 days MCRT and 6 hours of HRT. Assuming BOD_5 20°C as 175 mg/L in influent to the aeration tank, sludge wasting flow equal to 70 m³/d and return sludge concentration equal to 8000 mg/L, determine the concentration of MLVSS to be maintained in the aeration tank to achieve effluent BOD_5 of 30 mg/L. Also determine the recirculation ratio at which plant should be operated. Assume the kinetic coefficients $K_d = 0.06 \text{ d}^{-1}$ and $Y = 0.6$. 07

- Q.4** (a) Apply suitable formula to determine detention time of equalization tank. 03
(b) Describe complete mix Activated Sludge Process with neat sketch. 04
(c) Design a bio-tower to treat a wastewater flow of 10 MLD having settled BOD_5 equal to 175 mg/L and to be operated at 25°C. The depth of modular plastic media to be used is 6 m and the recirculation ratio will be 2:1. The treatability constant determined at 20°C is found to be 0.06 min^{-1} and desirable concentration of effluent BOD_5 is 20 mg/L. 07

OR

- Q.4** (a) Write the Eckenfelder equations (with & without recirculation) for Bio tower design. 03
(b) Analyze differences between attached growth and suspended growth systems. 04
(c) Analyze design considerations of aeration system and secondary clarifier. 07

- Q.5** (a) Analyze the role of aeration in biological treatment process. 03
(b) Write a short note on Bio Tower and explain how it is differ than Trickling Filter. 04
(c) Assuming suitable design criteria and following characteristics of domestic wastewater, design a UASB reactor system to treat an average 5 MLD flow of wastewater. Assume up flow velocity is 0.5 m/h. Given Data: 07
Influent $BOD = 320 \text{ mg/L}$
Influent $COD = 850 \text{ mg/L}$
Influent $TSS = 400 \text{ mg/L}$
Influent $VSS = 300 \text{ mg/L}$
Desired Effluent $BOD = 100 \text{ mg/L}$ or less

OR

- Q.5** (a) State any three sludge handling units used in treatment plant. 03
(b) Write down the design procedure of Up-flow Anaerobic Sludge Blanket reactor. 04
(c) Explain the phases of SBR operational cycle with neat sketch. 07
