Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE - SEMESTER–VII (NEW) EXAMINATION – WINTER 2022**

**Subject Code:3171306 Date:03-01-2023**

**Subject Name:Wastewater Engineering**

**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.**
4. **Simple and non-programmable scientific calculators are allowed.**

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| **Q.1** | **(a)** | Enlist and explain sources of Domestic wastewater. | **03** |
| | **(b)** | Draw a neat block diagram of Conventional Sewage Treatment Plant with appropriate labels. | **04** |
| | **(c)** | Differentiate between Industrial Wastewater and Municipal Wastewater. | **07** |
| **Q.2** | **(a)** | Write a short note on Operational Problems of following Primary Treatment Units : (1) Screens (2) Grit Chamber (3) Equalization Tank | **03** |
| | **(b)** | Write a short note on Operational phases of Sequential Batch Reactor with neat sketch. | **04** |
| | **(c)** | Determine the surface area and depth of Oil and Grease Trap to remove 180 mg/L of Oil and Grease from flow of 52000 $m^3$/day. Assume detention time 5 min and 250 $m^2$ surface area requirement for wastewater flow of 1 $m^3$/s. | **07** |
| | | **OR** | |
| | **(c)** | Determine Length and Width of Aerated Grit Chamber for average wastewater flow of 8 MLD. Also determine air requirement. Assume following data:<br>• Peaking Factor = 2.5<br>• Provision of 2 grit chambers in one unit<br>• Detention time = 5 min<br>• Depth = 2 m<br>• Width to Depth Ratio = 2:1<br>• Air supply rate = 0.3 $m^3$/min×meter | **07** |
| **Q.3** | **(a)** | What is Grit ? Discuss the significance of Grit Chamber. | **03** |
| | **(b)** | Write the Design Criteria of Horizontal Flow Grit Chamber. | **04** |
| | **(c)** | Determine number of bars and its length for Coarse screen with following data.<br>• Peak flow = 50 MLD<br>• Velocity through bar = 0.75 m/s<br>• Depth of Water in approach channel = 1 m<br>• Spacing between bars = 30 mm<br>• Width of bar = 12 mm | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | Define the following parameters and explain its importance in design (1) SOR (2) WOR (3) Detention Time | **03** |
| | **(b)** | Why equalization tank is required for industrial wastewater plan ? | **04** |
| | **(c)** | Determine Diameter and Depth of Sedimentation Tank to treat wastewater with following data and also check design for WOR and SOR at Peak flow.<br>• Avg wastewater flow = 35000 $m^3$/day<br>• SOR = 40 $m^3$/ $m^2$×day<br>• Detention Time = 2 hrs | **07** |

- Peaking Factor = 2.5

**Q.4** **(a)** Explain foaming as an operational problem of Activated Sludge Process and how to overcome it. **03**

**(b)** Explain bulking of sludge and how to overcome this problem. **04**

**(c)** Determine the diameter of Secondary Settling Tank with following data and check it for SOR and WOR. **07**

- Design flow = 13000 $m^3$/day
- Recycle ratio = 0.5
- MLSS Concentration = 2500 mg/L
- Solids Loading Rate = 108 Kg/$m^2$×day

**OR**

**Q.4** **(a)** Write a short note on Stabilization Pond. **03**

**(b)** Write operational problems of Anaerobic Treatment units **04**

**(c)** An activated sludge system is to be used for secondary treatment of 10000 $m^3$/day of municipal wastewater. After primary clarification, the BOD is 150 mg/L and it is desired to have not more than 5 mg/L of soluble BOD in the effluent. A completely mixed reactor is to used and pilot plant analysis has estimated the following kinetic values: Y = 0.5, Kd = 0.05 $d^{-1}$. Assume MLSS concentration of 3000 mg/L and underflow concentration of 10000 mg/L from secondary clarifier. Determine the following: (1) The volume of reactor (2) The mass and volume of solids that must be wasted each day (C) The recycle ratio. **07**

**Q.5** **(a)** Explain working of Rotating Biological Contactor. **03**

**(b)** Write a short note on Extended Aeration. **04**

**(c)** Determine number and size of Sludge Drying Beds to dewater the digested sludge produced from sewage treatment plant for 50000 population. Assume following Data: **07**

- Dry Solids Concentration in Primary and Activated Mix Sludge = 70 gm/Capita/Day.
- Dry Solids Loading Rate = 100 Kg/$m^2$/year
- Sludge contain 70% solids
- Specific Gravity of Sludge = 1.02

**OR**

**Q.5** **(a)** Differentiate between Diffused Aerator and Surface Aerator. **03**

**(b)** Draw a labeled diagram of UASB reactor and explain its component. **04**

**(c)** Determine volume of anaerobic sludge digestor for following data: **07**

- Wastewater Flow = 8 MLD
- Suspended Solids Concentration = 250 mg/L
- Volumetric Loading Rate = 45 $m^3$ digestor volume per 1000 persons
- Solids contribution = 70 gm/Capita/Day.

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