

GUJARAT TECHNOLOGICAL UNIVERSITY**BE – SEMESTER- VII EXAMINATION-SUMMER 2023****Subject Code: 2171306****Date: 21/06/2023****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.
4. Simple and non-programmable scientific calculators are allowed.

MARKS

- Q.1**
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|-----|---|-----------|
| (a) | Write a short note on oil and grease trap. | 03 |
| (b) | Differentiate between domestic wastewater and industrial wastewater. | 04 |
| (c) | Enlist and explain the operational problems of mechanically cleaned bar screen. | 07 |
- Q.2**
- | | | |
|-----|--|-----------|
| (a) | Enlist and Explain the operational problems of chemical unit operations. | 03 |
| (b) | Estimate the headloss for a clean bar rack and 50% blockage of bar rack. Assume following data: Approach Velocity in channel = 0.53 m/s, Velocity through Clean Screen = 0.93 m/s and Empirical discharge coefficient when bar rack is clean & blocked = 1.67 & 1.43 respectively. | 04 |
| (c) | Design an aerated grit chamber for an average flow of 10 MLD. Assume peaking factor 2.5, provide 2 chambers in one unit, air supply rate is 0.3 m ³ /minute/m length. Check for HRT & SLR. | 07 |
- OR**
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|-----|--|-----------|
| (c) | Enlist the various types of Rapid Mixers used for wastewater treatment. Differentiate between Rapid Mixing & Flocculation. | 07 |
|-----|--|-----------|
- Q.3**
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|-----|---|-----------|
| (a) | Write the Eckenfelder equations (with & without recirculation) for Bio tower design. | 03 |
| (b) | Define the following terms: (i) Sludge volume index, (ii) Mean cell residence time and (iii) Mixed liquor suspended solids | 04 |
| (c) | Design a bar rack (mechanically cleaned) for an average flow 40 MLD flow condition in incoming sewer is given by: Diameter of sewer = 1.53 m, Depth of flow at peak flow = 1 m, Velocity at peak design flow = 0.8m/s, Drop to screen chamber flow with respect to sewer invert is 0.08 and Peaking Factor = 2. | 07 |
- OR**
- Q.3**
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|-----|--|-----------|
| (a) | Enlist and explain operational problems of suspended growth processes. | 03 |
| (b) | Explain volumetric organic loading, upflow velocity and gas collection system. | 04 |
| (c) | Assuming suitable design criteria, compute the dimensions of a rectangular settling tank to remove suspended flocculent particles from the average wastewater flow of 15000 m ³ /d. A column test indicates that an overflow rate of 40 m/d will produce satisfactory removal of suspended floc at 3.5 m depth. | 07 |
- Q.4**
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|-----|--|-----------|
| (a) | Write a short note on extended aeration. | 03 |
| (b) | Explain the phases of SBR operational cycle with neat sketch. | 04 |
| (c) | Design a tube settler module of square cross section with following data: Design flow = 1.2 MLD, Diameter of tube = 50 mm, Length of tube = 1 m, Angle of inclination of tube = 60° with horizontal. | 07 |
- OR**
- Q.4**
- | | | |
|-----|--|-----------|
| (a) | Explain various methods of thickening of sludge. | 03 |
|-----|--|-----------|

- (b) Enlist and Explain the operational problems of chemical unit operations. **04**
- (c) If 1 MLD flow of domestic wastewater with settled BOD₅ of 250 mg/L is treated in the conventional activated sludge plant at 0.3 F/M ratio to obtain 85% BOD removal efficiency, estimate the net surplus sludge produced per day. Assume suitable reaction constants. **07**

- Q.5**
- (a) Explain briefly about basic processes for sludge treatment. **03**
 - (b) Write operational problem of UASB. **04**
 - (c) Design a rotating biological contactor to treat 10 MLD flow of municipal wastewater having BOD₅ concentration of 250 mg/L. The primary treatment removes 30% raw BOD₅ and desired effluent BOD₅ is 30 mg/L. Assume 0.05 m³/m².d hydraulic loading and suitable data if needed. **07**

OR

- Q.5**
- (a) State the purpose of filter presses and enlist the types of filter presses. **03**
 - (b) Draw a neat flow diagram and write down design criteria of sludge drying beds. **04**
 - (c) A wastewater treatment plant is being designed to process 50,000 m³/d of wastewater. Pilot plant analysis indicate that an alum dosage of 40 mg/L with flocculation at a Gt value of 4.0 X 10⁴ produces optimal results at the expected water temp 15°C. Determine: **07**
 - a) Monthly alum required
 - b) The flocculation basin dimensions if three cross-flow horizontal paddles are to be used. The Flocculator should be maximum of 12 m wide & 5 m deep in order to connect appropriately with settling basins. The depth of Flocculator should be 1/3 of length of basin
 - c) Determine the power requirement of each compartment
