BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BE **SEMESTER : VII**
BRANCH: BIOENGINEERING **SESSION : MO/18**

SUBJECT: BT7021-BIOLOGICAL WASTE MANAGEMENT

TIME: 03:00 HRS. **FULL MARKS: 60**

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) Determine COD for the compound $C_6H_{12}O_6$ [2]
(b) How do you measure in a lab (i) dissolve solid, (ii) volatile solid present in waste water? [4]
(c) The BOD_6 of a wastewater is determined to be 400 mg/L at 20°C. The k value at 20°C is known to be 0.23 per day. What would be (i) $BOD_8$and (ii) BOD_{10}value at 15°C? [6]

Q.2(a) What are the methods for removing oil and grease from waste water? [2]
(b) Draw a labeled diagram of a complete wastewater treatment process [4]
(c) With the help of diagram and equations, justify how settling velocity of particles ultimately help in determining the depth and length of a grit chamber. [6]

Q.3(a) Write one advantage and one disadvantage of trickling filter. [2]
(b) Draw a facultative lagoon system for waste water treatment. [4]
(c) An activated-sludge system is to be used for secondary treatment of 15,000 m^3/d of municipal wastewater. After primary clarification, the BOD is 170 mg/L, and it is desired to have not more than 25 mg/L of soluble BOD in the effluent. A completely mixed reactor is to be used, and pilot-plant analysis has established the following values: hydraulic detention time (θ_c) = 10 d, yield coefficient (Y) = 0.5 kg/kg, k_d=0.05 d^{-1}. Assuming an MLSS concentration of 4500 mg/L and an underflow concentration of 12,000 mg/L from the secondary clarifier, determine (i) the volume of the reactor, and (ii) the recycle ratio. [6]

Q.4(a) How can you convert aerobic lagoon into anaerobic one? [2]
(b) Write the (i) need and (ii) advantage of anaerobic treatment process. [4]
(c) With the schematic diagram, describe the sequential batch reactor (SBR) system. [6]

Q.5(a) Write the basic needs of a tertiary treatment process. [2]
(b) Write a short note on (i) nitrification and (ii) denitrification process. [4]
(c) Describe with diagram different membrane modules used in tertiary treatment. [6]

Q.6(a) Write the difference between incineration and pyrolysis. [2]
(b) Explain 3 'R's used in solid waste management. [4]
(c) Describe different sludge thickening methods. [6]

Q.7(a) Write the design criterion of a RBC. [2]
(b) Wastewater flow is 3500 m^3/d in winter and 6500 m^3/d in summer. Winter temperature is 5°C and summer is 40 °C. BOD_5 is 200 mg/L with 70% being soluble. The reaction coefficient k is 0.23 d^{-1} at 20°C, and the temperature coefficient is 1.06. Find volume of facultative lagoon to remove 80% of the soluble of BOD. [4]
(c) Design a grit chamber of rectangular cross-section. Following information is provided: Design Flow (Q): 50 MLD; settling velocity of the smallest particle to be removed completely is 0.0236 m/s; Specific Gravity of particles (Ss): 2.65; Horizontal mean flow velocity (V): 0.30 m/s; Theoretical depth (D): 1.4 m; Calculate the dimensions of the grit chamber. While designing the actual grit chamber, add 25 percent to the depth for grit collection, and 0.25m freeboard. Also add 50 percent to the theoretically calculated length. Value of 'n' is 0.020. Assume that the volume of grit in the wastewater is 0.15 m^3/ML, and 100 percent grit removal in the grit chamber. [6]

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