Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

VII SEMESTER B.TECH. (CHEMICAL ENGINEERING)

END SEMESTER EXAMINATIONS, Nov/Dec 2023

SUBJECT: PE-III : INDUSTRIAL WASTEWATER ENGINEERING

[CHE 4057]

REVISED CREDIT SYSTEM

Date : 30/11/2023 **Time: 2.30 to 5.30 pm** **MAX. MARKS: 50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A.	Compare foaming and bulking in activated sludge treatment units.	(3 marks)
1B.	Evaluate the importance of measurement of turbidity in wastewater	(3 marks)
1C.	Just below the point where a continuous discharge of pollution mixes with a river, the BOD is 10.9 mg/l and DO is 7.6 mg/l. The river and waste mixture has a temperature of 20°C, a deoxygenation constant of 0.20 day^{-1}, an average flow speed of 0.30 m/s and an average depth of 3.0 m. (i) Estimate the time and distance downstream at which the oxygen deficit is maximum (ii) Estimate the minimum value of DO.	(4 marks)
2A.	Explain Scour velocity, Approach velocity and Flow velocity.	(3 marks)
2B.	Write a short note on Grit chamber. Explain its importance and applications.	(3 marks)
2C.	Develop an expression for mean cell residence time and mass balance with biomass and with substrate using suitable mass balance equations for the sludge wastage from recirculation line.	(4 marks)
3A.	Design a high rate trickling filter with a flow rate of 150 m^3/hr. Influent BOD of raw wastewater is 180 mg/l. Effluent BOD is 30 mg/l. k = 0.1 day^{-1} at 20°C. The removable BOD is equal to 90% of the ultimate first stage BOD. Assume a depth of 2.7 m. Design the filter by using NRC equation.	(4 marks)

	NRC Equation Single stage $V.F = \frac{W1}{5.08}\left(\frac{E1}{1-E1}\right)^2$ Second stage $V.F = \frac{W2}{5.08}\left(\frac{E2}{(1-E1)(1-E2)}\right)^2$ $F = \frac{1+R}{(1+0.1R)^2}$	
3B.	Explain the recent developments in membrane filtration and reverse osmosis.	(3 marks)
3C.	Create a flow diagram for the following (i)Extended aeration process (ii) combined process of secondary treatment with contact filtration, carbon adsorption and reverse osmosis.	(3 marks)
4A.	Design a biodisc for 600 persons to remove 90% of BOD of 170 mg/l at the rate of 160 lpcd.Assume loading rate as 10 g/m3.day and volume of the tank as 40 m^3. Make the necessary check for efficiency using Ka as 2.3 $Se = \left[\frac{-Ka.A}{2.Q} \pm \sqrt{\left(\frac{Ka.A}{2.Q}\right) + S_o}\right]^2$ where, Ka = 2.3	(4 marks)
4B.	Write any three modifications done in ASP with a neat diagram	(3 marks)
4C.	Distinguish between (a) Suspended- and attached- growth processes (b) Aerobic and anaerobic processes (c) Nitrification and denitrification	(3 marks)
5A.	Compare the advantages and disadvantages of using chlorine, ozone and UV for disinfection of wastewater	(3 marks)
5B.	Evaluate different methods of sludge digestion in detail.	(3 marks)
5C.	Explain the following terms along with their significance (a)Recirculation Ratio (b) Sludge age (c) Sludge Volume Index (d)F/M ratio	(4 marks)