Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

IV SEMESTER MAKE UP EXAMINATIONS, July 2023

SUBJECT: OE- I : Water Treatment Technology [CHE 4303]

REVISED CREDIT SYSTEM

Date : 11/07/2023 **Time: 3 hrs** **MAX. MARKS: 50**

Instructions to Candidates:

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

1A.	The wastewater has a BOD_5 equal to 180 mg/l and a reaction rate k equal to 0.22/day. It also has a Total Kjeldahl Nitrogen content (TKN) of 30 mg/l. (i)Find the ultimate carbonaceous oxygen demand (CBOD) (ii)Find the ultimate nitrogenous oxygen demand (NBOD) (iii)Find the remaining BOD after 5 days have elapsed.	(3 marks)
1B.	Derive Streeter-Phelps equation for oxygen sag analysis and draw the oxygen sag curve	(4 marks)
1C.	What are the levels of wastewater treatment and classify the treatment process according to the level of advancement?	(3 marks)
2A.	What are the requirements of a water distribution system.	(3 marks)
2B.	Describe the following terms along-with their significance (i) Food/Microorganism ratio (ii) Hydraulic retention time (iii) Volumetric Loading rate (iv) Hydraulic Loading rate (v)Recirculation Ratio (vi) Sludge age	(3 marks)
2C.	What do you mean by sloughing and bulking?	(4 marks)
3A.	Determine the size of high rate trickling filter for the following data: Flow rate = 4.5 MLD, Recirculation ratio = 1.5 BOD_5 of raw effluent = 250 mg/lt BOD removal in PST = 30% Find effluent BOD desired.	(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.	Describe any two types of high rate anaerobic reactors with a neat flow diagram?	(3 marks)
3C.	Explain the different modifications of ASP with a neat flow diagram	(3 marks)
4A.	Prepare preliminary designs for a rotary disc type installation to serve 1000 persons. Assume 80% BOD removal at an organic load of 20 g BOD_5/m^3.day and 3m diameter discs spaced 5 cm apart on centres. At 54 g of BOD/person.day and 200 lpcd, Flow Q is 200 m^3/day.	(4 marks)
4B.	Explain the importance of measurement of fixed solids, volatile solids and total solids in industrial wastewater.	(3 marks)
4C.	A mechanically aerated lagoon provides 5 days detention time to a wastewater flow of 10000 m^3/day. If its depth is restricted to 3 m, estimate the lagoon dimensions so that the dispersion number D/uL will be 0.5 or less.	(3 marks)
5A.	Explain the recent developments in membrane filtration and Reverse Osmosis.	(4 marks)
5B.	Explain nitrification and De-nitrification process and compare their advantages and disadvantages	(3 marks)
5C.	Draw the flow diagram of the following (i)Extended aeration process	(3 marks)

$$Se = \left[\frac{-Ka.A}{2.Q} \pm \sqrt{\left(\frac{Ka.A}{2.Q}\right) + S_o}\right]^2$$

where, Ka = 2.3