Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

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A Constituent Institution of Manipal University

VII SEMESTER B.TECH. (CHEMICAL ENGINEERING)

MAKE UP EXAMINATIONS, Jan 2023

SUBJECT: PE-III : INDUSTRIAL WASTEWATER ENGINEERING

[CHE 4057]

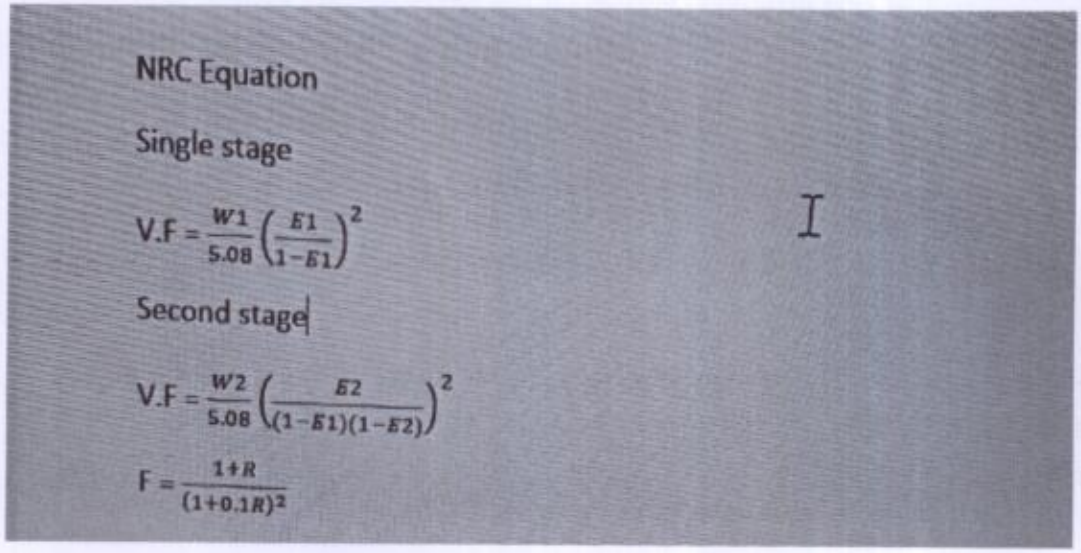
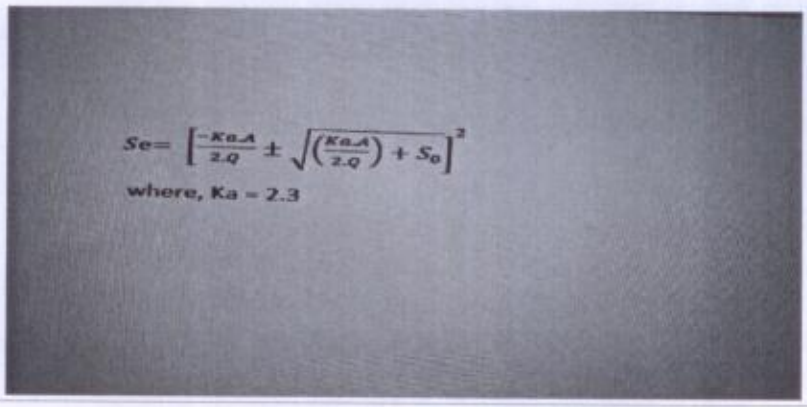
REVISED CREDIT SYSTEM

Date : 07/01/2023 **Time: 2.30 to 5.30 pm** **MAX. MARKS: 50**

Instructions to Candidates:

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

1A.	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.	A river is having discharge of 22 m3 /s receives wastewater discharge of 0.5 m3 /s. The initial DO of the river water is 6.3 mg/L, and DO content in the wastewater is 0.6 mg/L. The five day BOD in the river water is 3 mg/L, and the wastewater added to river has five day BOD of 130 mg/L. Consider saturation DO of 8.22 mg/L and deoxygenation and reaeration constant values of 0.1 and 0.3 per day, respectively. Find critical DO deficit and DO in the river after one day. The average velocity of flow in the stream after mixing of wastewater is 0.18 m/sec.	(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.	Draw a bacterial growth curve and explain the significance of various phases. Show that $Y_{obs} = \frac{Y_T}{\left(1+\frac{k_d}{\mu}\right)}$	(4 marks)
3A.	Determine the size of high rate trickling filter for the following data:	(4 marks)

	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.  	
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)

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5A.	Explain the recent developments in membrane filtration and Reverse Osmosis.	(4 marks)
5B.	Distinguish between (a) Suspended- and attached- growth processes (b) Aerobic and anaerobic processes (c) Nitrification and denitrification (d) Extended aeration and Conventional ASP process	(4 marks)
5C.	What do you mean by sloughing and what are the advantages and disadvantages of trickling filter?	(2 marks)