Reg. No.

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

I SEMESTER M.TECH. (EE) END SEMESTER EXAMINATIONS
FEBRUARY 2021
SUBJECT: APPLIED ENVIRONMENTAL CHEMISTRY AND MICROBIOLOGY [CIE 5183]

Date of Exam: 24/02/2021   Time of Exam: 2 pm-5 pm   Max. Marks: **50**

Instructions to Candidates:
❖ Answer ALL the questions & missing data may be suitably assumed

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1A.	i) With a suitable example explain pseudo-order reaction. ii) Write a short note on Rate Law and Le Chateliers Principle.	(03) (02)	CO1
1B.	Strontium 90 (^{90}Sr) is a radioactive nuclide of public health significance and has a half-life of 29 years. How long would a given amount of ^{90}Sr need to be stored to obtain a 99.9 percent reduction in quantity?	(02)	CO1
1C.	Explain the rules for the calculation of the oxidation number of compounds.	(03)	CO1
2A.	An adsorption study was conducted by adding varying amounts of granular activated carbon (GAC) to a series of seven flasks containing 1 litre of feed water used in soft drink preparation having an initial TOC of 0.9 mg/L. The flasks were agitated for 2h, and the residual, steady-state TOC concentrations were determined. Plot the Freundlich isotherms for the data presented below and determine the values of the appropriate constants. 	(05)	CO2
2B.	Derive the expression for efficiency of solvent extraction of solute from wastewater sample after nth extraction.	(05)	CO2
3A.	With a neat sketch explain the Helmholtz electrical double layer in colloids.	(05)	CO3
3B.	Derive the expression for Michaelis-Menten equation describing the rate of	(05)	CO3

Table for question 2A:

Mass of GAC added (g)	Final TOC (mg/L)
0.2	0.77
0.5	0.65
2.0	0.32
5.0	0.19
10	0.14
20	0.09
50	0.06

	enzymatic reactions.		
4A.	With a neat sketch explain the bacterial growth curve.	(05)	CO4
4B.	Explain the morphological characteristics (shapes and arrangements) of bacterial cells with neat sketches.	(02+03)	CO4
5A.	A coagulation treatment plant with a flow of 0.5 m³/sec is dosing alum at 23 mg/L. No other chemicals are being added. The raw water suspended solids concentration is 37 mg/L. The effluent suspended solids concentration is measured as 12 mg/L. The sludge content is 1 percent and density of sludge solids is 3.01 t/m³. What volume of sludge must be disposed of each day?	(05)	CO5
5B.	Calculate the annual cost of lime and soda for treating 70,000 litres of water per day, if water contains the following impurities: $CaCO_3$=280 ppm $Mg(HCO_3)_2$=100 ppm $CaSO_4$=110 ppm $MgCl_2$=138 ppm $MgSO_4$=80 ppm Purity of lime is 85% and soda is 100%. Lime costs Rs. 80 per kg and that of soda for Rs. 400 per kg.	(05)	CO5