

## VI SEMESTER B. Tech. BIOTECHNOLOGY

## **END SEMESTER EXAMINATION**

## Program Elective 2: Design of Biological Treatment Processes (BIO 4052)

Date:	08.05	.2024
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50

Duration: 3 hr

Max. Marks:

Q. No.	QUESTION		Marks	CO	BTL	
1A	You are asked to model a suspended growth treatment process. In this context, explain the significance of the determination of mixed liquor suspended solids and mixed liquor volatile suspended solids.		4	3	3	
18	The concentration of the substrate in the influent to a plug-flow mode waste water treatment system is 7500 ppm, while that in the effluent is 3075 ppm. If the system is being operated at a recycle ratio of 0.35, determine the concentration of the substrate in the influent to reactor after dilution. As you worked in the above system, you have realized that practically, a true plug- flow regime, is essentially impossible. What steps would you take to increase the efficiency of operation in the plug-flow mode?		4	3	4	
1C	What is the significance of determining the peaking factor in the design and operation of waste water treatment plants?		2	1	3	
2A	In a residential waste water treatment facil included for optimal treatment. The following of BOD Mass Loading Rate Peak BOD Mass Loading Rate Minimum BOD Mass Loading Rate Average BOD Mass Loading Rate Using the data, what is your conclusion	lty, an equalization Before equalization 439 17 213 about the ind	After equalization 271 132 213 clusion of the	4	2	4

	equalization tank? Do you think, this has been beneficial? Justify your			
	answer.			
2B	The avg flowrate at a small municipal WWT plant is 20,000 m <sup>3</sup> /d. The highest observed peak daily flowrate is 50,000 m <sup>3</sup> /d. Design rectangular primary clarifiers with a channel width of 6 m. Use a minimum of two clarifiers. Calculate the scour velocity, to determine if settled material will become resuspended. Estimate the BOD and TSS removal at average and peak flow. Use an overflow rate of 40 m <sup>3</sup> /m <sup>2</sup> .d at avg flow and a side water depth of 4 m. The following data are given. Cohesion constant = 0.05 Specific gravity = 1.25 Diameter of particles = 100 µm Darcy-Weisbach friction factor = 0.025	3	2	4
2C	What are the design considerations for dissolved-air flotation systems? How is the A/S determined for a system in which all the flow is pressurized?	3	2	2
3A	A dairy plant has installed a waste water treatment system to remove excess BOD using an attached growth-based reactor. The substrate concentration at a given point in the biofilm is $35.6 \text{ g/m}^3$ . The saturation constant is not determined. How would you assume a value for the same? The biomass concentration inside the system is found to be $150 \text{ g/m}^3$ . If the rate constant is determined as 0.09, determine the rate of substrate utilization in the biofilm. It is maintained that the substrate is a highly preferred one for the microbes.	4	3	4
3B	In which operational step(s) of the Sequencing Batch Reactor, is the total capacity of the reactor, completely filled? Give a description of those phase(s). When does sludge wasting occur in the SBR operation?	4	3	4
3C	Of the three configurations – Sequencing batch reactor, Trickling Filter and Rotating Biological Contactor, which is best suited for nitrification? Why?	2	3	3
4A	Sloughing was determined to be a major reason for the underperformance of a trickling filter used for waste water treatment. Reason out which parameters are aiding this phenomenon. What would be the solution that you would suggest to minimize/stop the same?	4	3	3
<b>4</b> B	You are asked to design two sizes of rotating biological contactors: one, a	4	3	3

	small scale and another, a much larger scale. Using a labelled schematic for each design, show the placement of the drive shafts.			
4C	What is the difference in the percentage of actual and available chlorine? How are they determined?	2	4	2
5A	How do the methods of chlorination, ozonation and UV radiation aid in the process of disinfection?	4	4	2
5B	A leather-processing industry has hired you to devise means to reclaim the water that is discharged as waste, from many of the unit operations. What applications would you suggest after the reclamation? List any three.	3	4	3
5C	If you are asked to to perform an environmental risk analysis, how would you identify the hazard and assess the associated exposure risk?	3	4	3