

**B.E. CHEMICAL ENGINEERING FOURTH YEAR SECOND SEMESTER EXAM 2024****ENVIRONMENTAL BIOTECHNOLOGY**

Time: 3 Hours

Full Marks: 100

*Answer **Question 1** and **Any Three** from the rest questions**Clearly mention all the assumptions**Clearly mention your roll number on the answer script as well on the graphs*

	Q. No 1	Q. No 2	Q. No 3	Q. No 4	Q. No 5	Q. No 6
CO 1	5	10	5			17
CO 2	10			18		8
CO 3	5		10			
CO 4	5	15	10	7	25	

1.

- a) Write the importance of combined trickling filter and activated sludge process in context of water treatment.
- b) Mention the importance of primary treatment step before activated sludge process.
- c) Write operational features of fluidised bed bioreactors.
- d) Mention the advantages of biological treatment process for Azo dye contaminated effluent.
- e) Highlight the principle of desulfurization of biogas with appropriate illustration.

25

- 2 a) Define bio augmentation process. Distinguish between the meanings of the term mixed culture and pure culture
- b) Briefly illustrate the role of microorganisms in waste water treatment with a mention of specific pollutant.
- c) Raw sewage with BOD of 440mg/L is applied to a conventional sewage treatment plant based on ASP. If the primary treatment unit removes 50% of BOD, determine the MLVSS to be maintained in the reactor to control an F/M ratio of 0.6, assuming a waste water flow rate of 1.5MLD. Volume of the reactor is 60m<sup>3</sup>.

4+6+15=25

[ Turn over

- 3 a) Explain with appropriate schematic the suspended growth and attached growth process with specific application features.  
 b) If BOD<sub>5</sub> of a waste water sample measured at 20°C is 250mg/L and the reaction constant k' (to base e) is 0.35d<sup>-1</sup>. Compute the ultimate and 7day BOD at 20°C.  
 c) Write in brief about importance 'quorum sensing' in bacterial biofilm formation

10+10+5=25

4. a) What is the effect of simultaneous nitrification and denitrification in activated sludge process? How the other environmental factors affect the process?  
 b) In biological phosphorus removal process mention the steps occurring in aerobic zone and anaerobic zone.  
 c) Mention the effluent characteristics for a treatment system with RBC. Give a schematic presentation of various RBC staging arrangements.

8+10+7=25

5. Determine the values of bio- kinetic constants using the data in Table 1 derived from the laboratory experiments carried out on the five sets of CSTR model of an activated sludge process without recycle.

Table 1

Model no.	Influent substrate concentration (mg/L)	Reactor substrate concentration mg/L	Detention time (HRT), days	Reactor Biomass concentration (mg/L)
	450	08	4.2	140
	450	12	3.2	120
	450	18	2.0	132
	450	48	1.3	123
	450	98	1.1	115

25

6. a) Write in brief about features of bioremediation process of various types with their merits and limitations.  
 b) Explain the bacterial growth curve and growth kinetics.  
 c) Mention the specific cases while bacterial growth equation follows first order and zero order kinetics.

8+12+5=25