

B.E. CHEMICAL ENGINEERING FOURTH YEAR SECOND SEMESTER EXAM 2025**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			10
CO2	10	10		12		10
CO3	5		10	6		5
CO4	5	5	10	7	25	

1.

- Mention the steps of the biofilm formation and its importance in environmental remediation.
- List the three basic types of ponds used in wastewater treatment processes. List four biochemical factors that can significantly affect pond operation.
- Mention some of the limitations of biodegradation process for environmental pollution treatment.
- Mention the importance of critical dilution rate for Chemostat.
- Why the build-up of a sludge blanket on the bottom of a pond will lessen the capacity of the pond?

25

- Mention the characteristic features of bacterial growth with specific mention of the cell divisions. Distinguish between the meanings of the term mixed culture and pure culture
 - Explain the methods for bacterial growth measurement with principle.
 - Calculate the generation time of a bacterial population in which the number of bacteria increase from 10^4 /mL to 10^7 /mL during four hours of exponential growth.

10+10+5

[Turn over

- 3 a) Mention the principles of Monod model and Michaelis-Menten Model. Write the significance of half velocity constant.
 b) If BOD_5 of a waste water sample measured at 20°C is 500mg/L and the reaction constant k' (to base e) is 0.35d^{-1} . Compute the ultimate and 21day BOD at 20°C .
 c) Write in brief about importance 'quorum sensing' in bacterial biofilm formation

10+10+5=25

4. a) In a culture of E.coli the cell population increased from 1.5×10^6 cells/mL to 12×10^6 cells/ml in 36 minutes. Calculate the generation time.
 b) Mention the effluent characteristics for a treatment system with RBC. Give a schematic presentation of various RBC staging arrangements.
 c) An RBC has a media surface area of $500,000\text{ft}^2$ and receives a flow of $1,000,000\text{gpd}$. If the soluble BOD concentration is 160mg/L , calculate the organic loading on RBC.

6+12+7=25

5. a) Assuming the F/M ratio equal to 0.25 and hydraulic residence time of 6hr, compute the value of MLVSS to be maintained in the reactor of a conventional activated sludge treatment plant designed to treat 5MLD settled waste water with 200mg/L of BOD_5 . Daily water flow $5000\text{m}^3/\text{day}$, influent BOD_5 200mg/L , F/M ratio 0.25 and hydraulic retention time of 6hr.

- a) Determine volume of reactor
 b) Compute daily amount of food fed to the reactor
 c) Compute the mass of MLVSS to be maintained in the water

- b) Raw sewage with BOD of 220mg/L is applied to a conventional sewage treatment plant based on activated sludge process. If the primary treatment unit remove 25% of the BOD, determine the MLVSS to be maintained in the reactor to control an F/M ration of 0.6, assuming a wastewater flow rate of 0.5MLD, and volume of reactor as 57.0m^3 .

15+10

6. a) Write in brief about components of Activated Sludge Process and the importance of components in waste water treatment.
 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.

10+10+5=25