JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- 2025

B.Tech.-V Semester (BT/BI)

COURSE CODE (CREDITS): 18B11BT511 (04) MAX. MARKS: 35

COURSE NAME: Bioprocess Engineering

COURSE INSTRUCTORS: Dr. Saurabh Bansal MAX. TIME: 2 Hours

Note: *(a) All questions are compulsory.*

(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems.

(c)Scientific Calculator is allowed.

Q. No.	Question	CO	Marks
Q 1	**a)** What is the difference between sterilization and disinfection?	IV	**[2]**
	b) A medium contains 10^6 spores per cm^3. Calculate the Del factor required to reduce contamination to 10^{-3} probability of survival.		**[1]**
Q 2	**a)** Explain various factors affecting k_La in a fermenter.	IV	**[3]**
	b) List the different methods of k_La estimation. Which method is more accurate in k_La estimation and why?		**[3]**
	c) A fermenter shows $k_La = 0.05\ s^{-1}$ and $C^* = 8$ mg/L. If $C_L = 2$ mg/L, calculate the oxygen transfer rate (OTR).		**[1]**
Q 3	**a)** Why is foam control critical in bioreactor operations?	V	**[1]**
	b) Why KOH is preferred over NaOH as neutralizing agent for pH control?		**[1]**
	c) What is the function of condenser in a fermenter?		**[1]**
	d) What is the role of instrument air in bioreactor operations?		**[1]**
	e) Compare top-entry vs. bottom-entry impellers in terms of design and maintenance.		**[2]**
Q 4	Explain the advantages and limitations of immobilized cell bioreactors.	V	**[2]**
Q 5	Compare which one is better: fixed bed reactors and fluidized bed reactors for immobilized cells and why?	V	**[2]**

Q 6	**a)** Draw and label a neat, well-annotated diagram of an Airlift Bioreactor, explaining its major components and working principle. **b)** Compare which Bioreactor is better: Airlift or Bubble Column Bioreactor and why?	V	**[2]** **[2]**
Q 7	**a)** Define bioreactor scale-up and its importance. **b)** A fungal fermentation shows poor yield when scaled from 10 L to 10,000 L. Identify possible causes and suggest corrective strategies. **c)** In a mammalian cell culture, high impeller tip speed caused cell death. Which scale-up criterion should be prioritized to avoid this issue? **d)** What does VVM (Vessel Volumes per Minute) represent in gassing parameters?	VI	**[2]** **[2]** **[1]** **[1]**
Q 8	A stirred-tank reactor is to be scaled down from 10 m^3 to 0.1 m^3. The dimensions of the large tank are: $Dt = 2$ m; $Di = 0.5$ m; $N = 100$ rpm. **a)** Determine the dimensions of the small tank (*Dt, Di, H*) by using geometric similarity **b)** What would be the required rotational speed of the impeller in the small tank if the impeller Re number (Re_i) were used as a scale down criteria?	VI	**[3]** **[2]**