JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- 2025

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

COURSE CODE (CREDITS): 18B11BT511 MAX. MARKS: 25

COURSE NAME: Bioprocess Engineering

COURSE INSTRUCTORS: Dr. Saurabh Bansal MAX. TIME: 1 Hour 30 Min

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

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

Q. No.	Question	CO	Marks
Q1 a)	What do you understand by mixing? Why mixing is important in a bioprocess?	I	2
Q1 b)	List the different mixing Equipments used in a fermenter along with their primary function.	I	3
Q2 a)	Two organisms have the same D-value at a given temperature, but organism A has a higher z-value than B. Which organism is more sensitive to changes in temperature and why?	II	1
Q2 b)	You must sterilize a heat-sensitive enzyme solution. Choose between sterile filtration (0.22 μm) and autoclaving. Explain your decision with suitable reasons.	II	1
Q3	A fermentation process shows reduced product yield at higher agitation speeds. Can you propose the possible reasons related to mixing and shear? Also suggest possible solution for each reason.	II	2
Q4	Why is fed-batch culture preferred for secondary metabolite production?	III	1
Q5	Differentiate between: a) Axial and Radial Flow Impellers b) Fed-batch Culture and Chemostat	III	2+2
Q6	For a fed-batch system, assume at $t = 0$, $V = 100$ l, $X = 2$ g/l, $\mu = 1$ h^{-1}, $S_0 = 4$ g/ l, and $S = 0.01$ g/l. V is increased at a constant rate such that	III	2+1

	dV/dt = 20 l/h = F (or flow rate) and X is constant at all times. a) Derive a formula to relate μ to V and dV/dt. b) What is μ at t = 5 h?		
Q7	A fermentation broth is subjected to a sterilization cycle in a batch process. The broth is heated from 100 °C to 121 °C over 30 minutes, held at 121 °C for 15 minutes, and then cooled back to 100 °C over 17 minutes. Other information given as: The Del factor for heating from 100°C to 121°C at 1 °C/min is 0.050. The Del factor for cooling from 121°C to 100°C at 1 °C/min is 0.080. The Del factor during the holding phase at 121°C is 15.0 (since it's constant temperature for 15 min). Assume that Del factors scale linearly with the rate of temperature change. Calculate the adjusted Del factor for the heating and cooling phase.	IV	2
Q8	Which system is consumed less mixing power: Gassed and Ungassed fluid? Why?	IV	2
Q9	A fermentation broth with viscosity 100 centipoise and density 1000 kg m^{-3} is agitated in a 2.7 m^3 baffled tank using a Rushton turbine with diameter 0.5 m and stirrer speed 2 s^{-1}. Estimate the mixing time.	IV	2
Q10	With the increase volume of medium what will happen generally to the following while keeping other factors constant: a) Del factor b) Mixing time	IV	2