Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VII (NEW) EXAMINATION – WINTER 2018

Subject Code: 2170407   **Date: 26/11/2018**
Subject Name: Biochemical Engineering-I
Time: 10:30 AM TO 01:00 PM   **Total Marks: 70**
Instructions:
      1. **Attempt all questions.**
      2. **Make suitable assumptions wherever necessary.**
      3. **Figures to the right indicate full marks.**

                                                                                     MARKS

Q.1 **(a)** Define the terms: Respiratory quotient, Yield, Growth rate limiting reaction.   **03**
     (b) Discuss the sterilization of air for the fermentation operation.   **04**
     (c) A fermenter containing microbial culture at 30 ^{0}C is used for production of   **07**
microbial insecticide with its 20-litre capacity. K_La is to be determined. Air flow is shut off for few minutes and DO level drops the air supply is then reconnected. When steady state is established, the DO tension is 77%   air saturation.
           The following results are obtained.

	T_1	T_2
Time	5	15
Oxygen tension	50	66

           Where, C_{AL} = final steady DO concentration and C_{AL} = DO Concentration.   (a) Estimate K_La. (b) An error is made determining steady state oxygen level, which instead of 77% is taken as 69%, what

Q.2 **(a)** How do the analogy exists between mass and heat transfer?   **03**
     (b) Discuss the basic steps for designing of a bioreactor.   **04**
     (c) The fungus *Aureobasidium pullulans* is used to produce extracellular   **07**
polysaccharides by fermentation of sucrose. After 120h fermentation, the following measurements of shear stress and shear rate were made with a rotating cylinder viscometer.

Shear Stress dyn cm^{-2}	Shear Rate s^{-1}
44.1	10.2
235.3	170
357.1	340
457.1	510
636.8	1020

        [1] Plot the rheogram for this fluid.
        [2] Determine the appropriate Non Newtonian parameters.
        [3] find the apparent viscosity at the shear rates of ; 15 s^{-1} and 200 s^{-1}.

OR
     (c) A bacterium converts ethanol to acetic acid under aerobic conditions. A   **07**
continuous fermentation process for vinegar production is proposed using non-viable bacterial cells immobilized on the surface of gelatin beads. The production target is 2 kg h^{-1}acetic acid; however the maximum acetic acid

concentration tolerated by the cells is 12%. Air is pumped into the fermenter at a rate of 200 mmol h^{-1}.

    (a) What minimum amount of ethanol is required?

    (b) What minimum amount of water must be used to dilute the ethanol to avoid acid inhibition?

Q.3	**(a)**	Derive the equations for Eddie-Hofstee plot and Lineweaver –Burke plot.	**03**
	(b)	Enlist the energy concerns from heat transfer point of view for a bioreactor.	**04**
	(c)	Write about Non- Newtonian fluids with suitable equations. Explain each of them for its stress and strain relation analogous to the law of viscosity.	**07**

OR

Q.3	**(a)**	Discuss the dynamic method to determine $K_L a$.	**03**
	(b)	Enlist the enzymes which are medical importance.	**04**
	(c)	Discuss the practical considerations for bioreactor constructions.	**07**
Q.4	**(a)**	Write a note on: Orifice and Nozzle spargers	**03**
	(b)	Discuss aseptic operation by giving schematic to show operating procedures.	**04**
	(c)	Explain the concept of air lift bioreactor. Compare it with fluidized bed bioreactor.	**07**

OR

Q.4	**(a)**	What is the importance of modeling? Where and how does it help in fermentation plants?	**03**
	(b)	Explain the measurement of DO concentrations.	**04**
	(c)	Justify the statement: "Chemostate culture evaluates the kinetic and yield parameters."	**07**
Q.5	**(a)**	Derive equation to narrate death kinetics of cell culture.	**03**
	(b)	How cells grow? Which factors affect?	**04**
	(c)	Define bioprocess engineering. Explain the role of biotechnology in that.	**07**

OR

Q.5	**(a)**	What are the effects of conditions on Enzyme reaction rate?	**03**
	(b)	Write a note on: Assessing mixing effectiveness	**04**
	(c)	Write the transfer of oxygen from gas bubbles to cell.	**07**

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