Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) EXAMINATION – WINTER 2022

Subject Code:3170407 Date:03-01-2023

Subject Name:Biochemical Engineering

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.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Explain growth associated, mixed growth associated and non-growth associated products with graphical representation of each.	**03**
	(b)	Compare Chemostat and turbidostat.	**04**
	(c)	Fermentation slurry containing *Streptomyces kanamyceticus* cells is filtered using a continuous rotary vacuum filter. 120 kg h^{-1} slurry is fed to the filter; 1 kg slurry contains 60 g cell solids. To improve filtration rates, particles of diatomaceous-earth filter aid are added at a rate of 10 kg h^{-1}. The concentration of kanamycin in the slurry is 0.05% by weight. Liquid filtrate is collected at a rate of 112 kg h^{-1}; the concentration of kanamycin in the filtrate is 0.045% (w/w). Filter cake containing cells and filter aid is continuously removed from the filter cloth. (a) What percentage liquid is the filter cake? (b) If the concentration of kanamycin in the filter-cake liquid is the same as in the filtrate, how much kanamycin is absorbed per kg filter aid?	**07**
Q.2	**(a)**	Explain distribution, dispersion and diffusion types of mixing.	**03**
	(b)	Explain film theory in detail.	**04**
	(c)	Water at 25°C enters an open heating tank at a rate of 10 kg h^{-1}. Liquid water leaves the tank at 88°C at a rate of 9 kg h^{-1}; 1 kg h^{-1} water vapor is lost from the system through evaporation. At steady state, what is the rate of heat input to the system? h(liquid water at 88°C = 368.5 kJ kg^{-1} h(saturated steam at 88°C = 2656.9 kJ kg^{-1} h (liquid water at 25°C = 104.8 kJ kg^{-1}	**07**
		OR	
	(c)	Classify fluids according to their rheological behavior and show their graphical presentation.	**07**
Q.3	**(a)**	What is difference between aseptic condition and sterilization?	**03**
	(b)	Explain the terms theoretical and observed yields, overall and instantaneous yield.	**04**
	(c)	Explain the Steps for transfer of oxygen from gas bubble to cell with proper diagram.	**07**
		OR	
Q.3	**(a)**	Explain different sparger designs.	**03**
	(b)	The equation for aerobic production of acetic acid from ethanol is: C_2H_5OH (Ethanol) + O2 → CH_3CO_2H (acetic acid) + H_2O. *Acetobacter aceti* bacteria are added to vigorously-aerated medium containing 10 g l^{-1} ethanol. After some time, the ethanol concentration	**04**

is 2 g l^{-1} and 7.5 g l^{-1} acetic acid is produced. How does the overall yield of acetic acid from ethanol compare with the theoretical yield?

(c) A 20 1 stirred fermenter containing a *Bacillus thuringiensis* culture at 30^oC is used for production of microbial insecticide, kL_a is determined using the dynamic method. Air flow is shut off for a few minutes and the dissolved-oxygen level drops; the air supply is then re-connected. When steady state is established, the dissolved-oxygen tension is 78% air saturation. The following results are obtained. **07**

Time(s)	5	15
Oxygen tension (% air saturation)	50	66

a) Estimate kL_a. (b) An error is made determining the steady-state oxygen level which, instead of 78%, is taken as 70%. What is the percentage error in kL_a resulting from this 10% error in C_{AL}?

Q.4 **(a)** How can heat sensitive liquids be sterilized? **03**

(b) Explain various factors affecting cellular oxygen demand. **04**

(c) *Aspergillus niger* is used to produce gluconic acid. Product synthesis is monitored in a fermenter; gluconic acid concentration is measured as a function of time for the first 39 h of culture. **07**

Time (h)	Acid concentration (g/l)
0	3.6
16	22
24	51
28	66
32	97
39	167

(a) Determine the rate constant.

(b) Estimate the product concentration after 20 h.

OR

Q.4 **(a)** Why is airlift loop reactor better than bubble column reactor? **03**

(b) Draw diagram of a typical stirred tank fermenter. **04**

(c) Explain kinetics of cell death. **07**

Q.5 **(a)** Why evaporational control an important aspect for any industry? **03**

(b) What is balanced growth? **04**

(c) Derive batch reaction time for an enzymatic reaction. **07**

OR

Q.5 **(a)** What cost cutting strategies can be adopted in industry being Biotechnology Engineer? **03**

(b) Explain simulation of model taking example of plasmid stability. **04**

(c) Explain various components of biosensor and explain any one type of biosensor with its application. **07**

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