Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VI(NEW) – EXAMINATION – SUMMER 2019

Subject Code:2160508   **Date:18/05/2019**
Subject Name:Biochemical Engineering
Time:10:30 AM TO 01:00 PM   **Total Marks: 70**
Instructions:
1. **Attempt all questions.**
2. **Understand the question carefully and write in proportion to marks it carries.**
3. **Provide explanation wherever required.**
4. **Figures to the right indicate full marks.**

Q.1	**(a)**	State three differences between a chemical reaction and its biochemical counterpart.	**03**
	(b)	Explain with a diagram various phases of microbial growth. Which phase is the longest?	**04**
	(c)	Discuss with examples the application of fermentation technology in food and beverage, industrial solvents, and antibiotics production.	**07**
Q.2	**(a)**	Name three industrially important biochemical reactions and mention the name(s) of the microorganism involved therein.	**03**
	(b)	State and explain different types of solid and liquid media used for microbial growth.	**04**
	(c)	Discuss various methods of cell disruption to get intracellular products. Give two examples of such intracellular products.	**07**
		OR	
	(c)	State and briefly explain various steps, either sequential or concurrent, of an integrated bioprocess in general.	**07**
Q.3	**(a)**	State three methods for the measurement of microbial growth.	**03**
	(b)	Write down Monod equation of microbial growth kinetics. Explain various terms in the same equation. How do you determine the kinetic parameters of the above equation graphically?	**04**
	(c)	Using substrate and biomass balance derive the design equation for a continuous stirred tank system for biochemical process. State the assumptions. Comment on critical dilution rate and washout factor.	**07**
		OR	
Q.3	**(a)**	What are the temperature, pressure and time conditions for steam sterilization? Name a few methods for sterilization of medium other than using steam.	**03**
	(b)	Calculate the steady state substrate and biomass concentration in a continuous fermenter which has an operating volume of 25 L. When the sterile feed stream contains limiting substrate at 2000 mg/L and enters the vessel at 8L/h. The values of K_s and μ_m are 10.5 mg/L and 0.45 h^{-1} respectively and the yield coefficient may be taken as 0.48.	**04**
	(c)	Illustrate various probable configurations of fed-batch bioreactors with schematic diagrams.	**07**

Q.4 **(a)** Write down the differences between prokaryotic and eukaryotic cells with examples. **03**

(b) How does an enzyme work? Classify enzymes with examples. **04**

(c) Draw a schematic diagram of a fermenter, label its different parts and state the functions of major parts. **07**

OR

Q.4. **(a)** What are different types of controlling system in fermenter? **03**

(b) Write a note on biosensors for fermentation control. **04**

(c) Discuss various monitoring and control parameters of an ideal fermenter. **07**

Q.5 **(a)** Explain why oxygen needs to be supplied at a sufficient rate during aerobic fermentation. **03**

(b) Explain various physico-chemical parameters affecting volumetric mass transfer coefficient K_La. **04**

(c) State various methods of determination of volumetric mass transfer coefficient K_La in a fermenter and explain any one. **07**

OR

Q.5 **(a)** Name various unit operations used in upstream and down stream processing in fermentation. **03**

(b) Discuss briefly the rheological behaviour of fermentation broth with appropriate examples. **04**

(c) Explain differential centrifugation method for separation of cells from fermentation broth. **07**

****