Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E. SEMESTER –IV(NEW) Examination –SUMMER 2017

Subject code: 2743004 **Date:03/05/2017**

Subject Name: Bioprocess &Biochemical Engineering

Time: 02:30 pm to 05:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Derive the rate equation for enzyme catalyzed reaction stating the assumptions How do you determine the kinetic parameters of the above equation?	**07**
	(b)	Obtain the design equations for continuous stirred tank fermenter in series. Draw the schematic and state the assumptions. Explain critical dilution rate and wash out condition.	**07**
Q.2	**(a)**	Illustrate with diagrams different configuration of protein structure. What are the biological functions of protein	**07**
	(b)	Discuss thermal death rate kinetics during sterilization of microbial cells.	**07**
		OR	
	(b)	Explain the advantages and various methods of enzyme immobilization with sketches.	**07**
Q.3	**(a)**	Explain with a diagram and example how various organelles of eukaryotic cells can be separated by differential centrifugation.	**07**
	(b)	State Monod Equation explaining each terms in it. How do you determine the constant parameters of Monod equation? Is there any limitation of this equation?	**07**
		OR	
Q.3	**(a)**	In general do CSTRs lend themselves more easily to parameter evaluation than PFRs? Why or why not?	**07**
	(b)	A liquid medium in a batch fermenter having working volume 1000L is sterilized in situ at 122°C. The initial concentration of bacterial spores in the medium was found to be 5×10^5 ml^{-1}. The sterility level after the holding cycle of sterilization is desired not to exceed 10^{-3} ml^{-1}. Initial temperature of the medium is 32°C and during heating cycle 10% of microorganism is expected to be destroyed. Calculate the holding time. Additional data given (Thermal death rate constant $\alpha = 8.0 \times 10^{38}$ min^{-1}; $E = 29 \times 10^7$ J/kmol	**07**
Q.4	**(a)**	Discuss various correlations dimensionless numbers with mass transfer coefficients for bubble and bubble swarms in freely rising or falling bodies.	**07**
	(b)	Distinguish between prokaryotic and eukaryotic cells. Explain the salient features of different types of eukaryotes and proakryotes with more elaboration.	**07**

OR

Q.4	**(a)**	Enlist various gas-liquid mass transfer resistances in cellular system.	**07**
	(b)	State various methods of determination of volumetric mass transfer coefficient and explain any one. State the factors affecting volumetric mass transfer coefficient.	**07**

Q.5 **(a)** Name various unit operations involved in bioprocess. **07**

Aerobic degradation of benzoic acid by a mixed culture of microorganisms can be represented by the following reaction

$C_6H_5COOH + a\ O_2 + b\ NH_3 \Rightarrow c\ C_5N_7NO_2 + d\ H_2O + e\ CO_2$

(Substrate) (Bacteria)

(a) Determine a,b,c,d and e if RQ =0.9

(b) Determine the yield coefficients, $Y_{X/S}$ and $Y_{X/O2}$.

Determine the degree of reduction for the substrate and bacteria.

(b) Briefly describe various methods of product separation and purification operations in bioprocess industries. **07**

OR

Q.5	**(a)**	Discuss enzyme inhibition, and its types with examples.	**07**
	(b)	Discuss different factors that are required to consider while scaling up of a fermenter.	**07**

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