Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII EXAMINATION – SUMMER 2016

Subject Code:170506 **Date:05/05/2016**

Subject Name:Biochemical Engineering (Department Elective-I)

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)**	Starting from the basic reaction between enzyme (E) and substrate (S) derive the Michaelis-Menten equation for the rate of enzyme catalyzed reaction. How do you graphically determine the constant kinetic parameters of the above equation?	**07**
	(b)	Explain the basic hypothesis of 'lock and key model' and 'Induced fit model' of enzyme –substrate reaction. Name a few industrially important enzymes with their uses.	**05+02**
Q.2	**(a)**	Briefly compare prokaryotic and eukaryotic cells in terms of internal structure and functions. Give example of any one prokaryotes and discuss briefly its salient features and types, if any.	**04+03**
	(b)	State and explain the principle of cell fractionation by differential centrifugation method.	**07**
		OR	
	(b)	Describe diagrams the primary, secondary and tertiary structure of proteins. Explain protein denaturation.	**07**
Q.3	**(a)**	Assume that experimental measurements for a certain organism have shown that cells can convert two-thirds (wt/wt) of the substrate carbon (glucose) into biomass according to the following reaction: $C_6H_{12}O_6 + aO_2 + bNH_3 \rightarrow c(C_{4.4}H_{7.3}N_{0.86}O_{1.2}) + dH_2O + eCO_2$ i) Calculate the stoichiometric coefficients a,b,c,d and e of the above reaction. ii) Also calculate the yield coefficients $Y_{x/s}$ and $Y_{x/O2}$	**07**
	(b)	Enlist the advantages and disadvantages of continuous culture of microorganisms. Explain 'Fed batch culture' in brief.	**07**
		OR	
Q.3	**(a)**	What are the different methods for measurement of microbial growth? Draw a typical growth curve of a microorganism to show various phases of growth by highlighting salient features of each of them.	**04+03**
	(b)	Discuss the important reactions of nitrogen cycle. What is the importance of nitrogen cycle on our environment?	**07**
Q.4	**(a)**	Briefly describe various methods of product separation and purification operations in bioprocess industries.	**07**
	(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 8 l/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.	**07**

OR

Q.4	**(a)**	Discuss with a flow diagram the production of lactic acid by fermentation method. State the industrial uses of lactic acid.	**07**
	(b)	Explain the advantages of Enzyme immobilization. Discuss various methods of enzyme immobilization with neat sketches.	**07**
Q.5	**(a)**	Discuss with a flow diagram the industrial production of single cell protein. State the uses of single cell protein.	**07**
	(b)	Write down Monod equation of microbial growth and explain the terms therein. How do you determine the kinetic constants? Is there any limitation of the above equation?	**07**

OR

Q.5	**(a)**	Enlist various parameters for characterizing biological wastes. Write a short note on biodegradation.	**07**
	(b)	Write a note on biogas production with special reference to biomethane.	**07**

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