Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII EXAMINATION – WINTER 2015

Subject Code: 170506 **Date:04/12/2015**

Subject Name: Biochemical Engineering

Time: 10:30am to 1:00pm **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)**	Briefly compare prokaryotic cells with eukaryotic cells in terms of internal structure and functions. Take any example from prokaryotes and discuss its salient features.	**04+03**
	(b)	Starting from the basic relationship between substrate and enzyme, derive Machaelis-Menten equation stating all the assumptions. How do you evaluate the kinetic parameters of the above equation graphically?	**07**
Q.2	**(a)**	Discuss various steps of nitrogen cycle in the environment with chemical reactions. What is its importance?	**07**
	(b)	Explain with a diagram different phases of microbial growth. State and explain various methods of estimation of cell growth.	**07**
		OR	
	(b)	Aerobic degradation of benzoic acid by a mixed culture of organisms can be represented by the following reaction: $C_6H_5COOH + aO_2 + bNH_3 \longrightarrow c\,C_5H_7NO_2 + dH_2O + eCO_2$ (substrate) (bacteria) i) Determine a,b,c,d and e if RQ = 0.9 ii) Determine the yield coefficients, $Y_{x/s}$ and $Y_{x/O2}$	**07**
Q.3	**(a)**	Explain 'Lock and Key' and 'Induced fit Model' of enzyme-substrate complex formation hypothesis.	**07**
	(b)	Classify enzymes with examples. Explain different types of Enzyme Inhibition	**07**
		OR	
Q.3	**(a)**	Explain different methods of enzyme immobilization with rough diagrams. What are the advantages of enzyme immobilization?	**07**
	(b)	Discuss primary, secondary and tertiary structure of protein. Give examples of various biological functions of protein.	**07**
Q.4	**(a)**	Derive the design equation for the continuous stirred tank fermenter in series.	**07**
	(b)	State the advantages and disadvantages of the continuous culture.	**07**
		OR	
Q.4	**(a)**	Discuss the production of Single cell protein with a diagram. State the uses of single cell protein.	**07**
	(b)	Discuss anaerobic digestion and biodegradation in context with biological waste water treatment.	**07**

Q.5 **(a)** Discuss the production of lactic acid with a flow diagram. State the applications of lactic acid. **07**

(b) Give examples (one each) of the following: (i) Transport protein (ii) Disaccharide (iii) Polysaccharide (iv) Unsaturated fatty acid (v) cofactor (vi) Coenzyme (vii) Information biomolecule. **07**

OR

Q.5 **(a)** A particular organism follows substrate-inhibited kinetic growth equation of Edwards as given below. The symbols are of usual meaning. **07**

$$\mu = \frac{\mu_m s}{K_s + s + \frac{s^2}{K_I}}$$

The kinetic parameters are (μ_m) 0.25 h^{-1}; K_s 2 g/L; and K_I = 1.35 g/L. Determine the value of substrate concentration at which the specific growth rate is maximum.

(b) A generalized form of the logistic equation is proposed by Konak: **07**

$$\frac{1}{N_\infty^{a+b}}\frac{dN}{dt} = k\left(\frac{N}{N_\infty}\right)^a\left(1-\frac{N}{N_\infty}\right)^b$$

Where, N_∞ = stationary phase population

a,b, = constant

N = cell mass.

Show that the maximum growth rate occurs at $N/N_\infty = a/(a+b)$ and that its value is given by

$$\left.\frac{dN}{dt}\right|_{max} = \frac{kN_\infty^{a+b}a^a b^b}{(a+b)^{a+b}}$$

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