

CBCS SCHEME

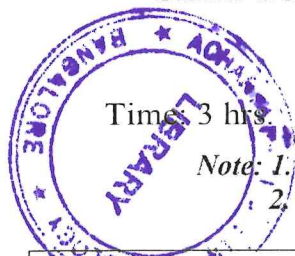
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BBT602

Sixth Semester B.E./B.Tech. Degree Examination, June / July 2026

Biokinetics



Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.

2. M : Marks , L: Bloom's level , C: Course outcomes.

Module – 1			M	L	C																								
Q.1	a.	Define Elementary and non- elementary reactions with examples.	08	L1	CO1																								
	b.	Explain temperature dependency of rate constant from Arrhenius law and also explain the significance of activation energy.	12	L2	CO1																								
OR																													
Q.2	a.	Define Order and molecularity of a reaction with examples.	08	L1	CO1																								
	b.	Explain the differential method of analysis of rate data for a constant volume system.	12	L2	CO1																								
Module – 2																													
Q.3	a.	Derive the performance equation for an ideal batch reactor for a constant volume system.	10	L4	CO2																								
	b.	It is proposed to operate a batch reactor for converting A into R. This is a liquid phase reaction with the stoichiometry $A \rightarrow R$. How long must we react each batch on order to drop the concentration from $C_{A_0}=1.3\text{mol/l}$ to $C_{A_r}=0.3 \text{ mol/l}$? The rate v/s concentration data are as given below, <table><tr><td>$C_A, \text{mol/l}$</td><td>$-r_A, \left(\frac{\text{mol}}{\ell \text{ min}} \right)$</td></tr><tr><td>0.1</td><td>0.1</td></tr><tr><td>0.2</td><td>0.3</td></tr><tr><td>0.3</td><td>0.5</td></tr><tr><td>0.4</td><td>0.6</td></tr><tr><td>0.5</td><td>0.5</td></tr><tr><td>0.6</td><td>0.25</td></tr><tr><td>0.7</td><td>0.1</td></tr><tr><td>0.8</td><td>0.06</td></tr><tr><td>1.0</td><td>0.05</td></tr><tr><td>1.3</td><td>0.045</td></tr><tr><td>2.0</td><td>0.042</td></tr></table>	$C_A, \text{mol/l}$	$-r_A, \left(\frac{\text{mol}}{\ell \text{ min}} \right)$	0.1	0.1	0.2	0.3	0.3	0.5	0.4	0.6	0.5	0.5	0.6	0.25	0.7	0.1	0.8	0.06	1.0	0.05	1.3	0.045	2.0	0.042	10	L5	CO2
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Q.4	a.	Derive the equation to calculate the mean residence time for the residence time distribution using pulse input experiment.	10	L5	CO2																								

b.	Calculate the mean residence time and the variance for a vessel from the following data.	10	L5	CO2																												
<table><tr><th>t, min</th><th>E, min⁻¹</th></tr><tr><td>0</td><td>0</td></tr><tr><td>1</td><td>0.02</td></tr><tr><td>2</td><td>0.1</td></tr><tr><td>3</td><td>0.16</td></tr><tr><td>4</td><td>0.2</td></tr><tr><td>5</td><td>0.16</td></tr><tr><td>6</td><td>0.12</td></tr><tr><td>7</td><td>0.08</td></tr><tr><td>8</td><td>0.06</td></tr><tr><td>9</td><td>0.044</td></tr><tr><td>10</td><td>0.03</td></tr><tr><td>12</td><td>0.012</td></tr><tr><td>14</td><td>0</td></tr></table>		t, min	E, min ⁻¹	0	0	1	0.02	2	0.1	3	0.16	4	0.2	5	0.16	6	0.12	7	0.08	8	0.06	9	0.044	10	0.03	12	0.012	14	0			
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Module – 3

Q.5	a.	Explain the theories for the formation of Enzyme – substrate complex.	08	L2	CO1
	b.	Demonstrate the application of Michaelis – Menten equation to Enzyme kinetics and also the significance of K_m and v_{max} .	12	L3	CO1

OR

Q.6	a.	Describe the Lineweaver – Burk plot and Eadie – Hofstee plot.	08	L2	CO1
	b.	Illustrate competitive, uncompetitive and non- competitive enzyme inhibition.	12	L3	CO1

Module – 4

Q.7	a.	Illustrate Batch growth kinetics.	10	L3	CO4
	b.	The experimental measurements for a certain organism have shown that cells can convert two – thirds (wt / wt) of the substrate carbon (alkane or glucose) to biomass. Calculate the stoichiometric coefficients for the following biological reactions. Hexadecane: $C_{16}H_{34} + aO_2 + bNH_3 \rightarrow c(C_{4.4}H_{7.3}N_{0.86}O_{1.2}) + dH_2O + eCO_2$ Glucose : $C_6H_{12}O_6 + aO_2 + bNH_3 \rightarrow c(C_{4.4}H_{7.3}N_{0.86}O_{1.2}) + dH_2O + eCO_2$	10	L4	CO4

OR

Q.8	a.	Derive the Monod equation.	10	L4	CO4
	b.	Analyze the factors affecting microbial growth.	10	L3	CO4

Module – 5

Q.9	a.	Describe the requirement of vitamins and minerals as a part of media for fermentation.	10	L2	CO5
	b.	Explain filter sterilization of liquid media.	10	L2	CO5

OR

Q.10	a.	Describe simple and complex media with examples.	10	L2	CO5
	b.	Explain the process of continuous heat sterilization of liquid media.	10	L2	CO5