Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET University)

B. Tech (Fifth Semester - Regular) Examinations, November – 2024

22BBTPC35003 – Biochemical Reaction Engineering

(Biotechnology)

Time: 3 hrs Maximum: 70 Marks

Answer ALL questions

(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

		CO #	Blooms Level
Q.1.	Answer ***ALL*** questions		
a.	Write the law of conservation of mass.	CO1	K1
b.	Reaction with high activation energies are very temperature sensitive. Show in the diagram.	CO2	K2
c.	Define pseudo first order reaction.	CO3	K1
d.	Define fermentation.	CO4	K1
e.	Define yield and selectivity.	CO1	K1

PART – B **(15 x 4 = 60 Marks)**

		Marks	CO #	Blooms Level
	Answer ***All*** the questions			
2. a.	A drier is fed with wet solid to reduce the moisture content from 80% to 15%. The product leaving the drier is admitted to an oven which further brings down the moisture to 2%. If the drier can handle 1000 kg of wet solid per hour, calculate the weight of water evaporated in the drier and in the oven per hour.	8	CO1	K2
b.	Draw a Psychrometric chart and explain its importance.	7	CO1	K1
	(OR)			
c.	The heat capacity of carbon dioxide is given by the following relation $Cp = 26.54 + 42.454 \times 10^{-3} T - 14.298 \times 10^{-6} T^2$ where Cp is in kJ/kmol. K and T is in K. How much heat is required to heat 1 kg of CO_2 from 300 K to 1000 K?	8	CO1	K3
d.	A gas analyzing CO_2=5.5%, CO=25%, H_2= 14%, CH_4= 0.5% and N_2=55% (by volume) is burnt in furnace with 10% excess air. If the conversion of CO, H_2, and CH_4 is 50%, 60% and 70% respectively, then estimate the composition of product mixture.	7	CO1	K2
3.a.	Discuss about the different types intermediates used in chemical reaction.	7	CO2	K2
b.	The data for the 1st order decomposition of benzenediazonium Chloride to Chlorobenzene & nitrogen are as follows.	8	CO2	K2

K (sec^{-1})	0.00043	0.00103	0.00180	0.00355	0.00717
T (K)	313	319	323	328	333

What is the activation energy & complete rate expression for this reaction?

(OR)

c.	How will you classify the chemical reaction based on different modes?	8	CO2	K2
d.	A rocket mixture burns a stoichiometric mixture of fuel (liquid hydrogen) in oxidant (liquid oxygen). The combustion chamber is cylindrical, 75cm long and 60 cm in diameter and the combustion process produces 108 kg /sec of exhaust gases. If the combustion is complete, find the rate of reaction of hydrogen and of oxygen.	7	CO2	K3
4.a.	Explain the volume comparison of CSTR and PFR with the help of $1/(-r_A)$ vs. X_A plot and V_{MFR}/V_{PFR} vs. $1-X_A$ plot, for +ve and 0 order reactions.	8	CO3	K2
b.	Derive the performance equation for irreversible second order bimolecular constant volume batch reactor.	7	CO3	K3
	(OR)			
c.	Derive an expression relating the volume of PFR and conversion and show in $1/(-r_A)$ vs. X_A plot.	8	CO3	K3
d.	Derive the performance equation for a variable volume batch reactor following 1st order rate kinetics.	7	CO3	K3
5.a.	Derive Michaelis-Menten equation for the enzyme catalyzed reaction.	8	CO4	K3
b.	Derive the expression for the rate of product formation for the reversible competitive enzyme inhibition and show the result in Line-Weaver-Burk plot.	7	CO4	K3
	(OR)			
c.	Explain the different phases of cell growth.	8	CO4	K3
d.	Differentiate reversible and irreversible inhibition.	7	CO4	K3

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