GIET UNIVERSITY, GUNUPUR – 765022

B. Tech (Fifth Semester Regular) Examinations, December – 2023

21BBTPC35003 – Biochemical Reaction Engineering

(Biotechnology)

Time: 3 hrs Maximum: 70 Marks

(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

	Q.1. Answer ***ALL*** questions	CO #	Blooms Level
a.	Calculate the weight fraction of Sodium chloride in 100 g of aqueous solution containing 20 g sodium chloride.	CO2	K4
b.	Define Kopp's rule and Hess's law.	CO1	K2
c.	On doubling the concentration of reactant, the rate of reaction triples. Find the reaction order?	CO2	K3
d.	Differentiate Integral method and differential method of interpretation of batch reactor data.	CO1	K2
e.	What are the parameters considered to maintain the favourable condition in the Fermenter?	CO2	K1

PART – B **(15 x 4 = 60 Marks)**

	Answer ***ALL*** questions	Marks	CO #	Blooms Level
2. a.	Octane is burnt with 10% excess air. Calculate: (i) Air/fuel ratio by weight (ii) Air/fuel ratio by volume.	7	CO2	K3
b.	A theoretical producer gas (35% CO and 65% N_2) at 25 ^{0}C is burnt with 50% excess air (preheated to 200 ^{0}C). Assuming complete combustion, calculate the theoretical flame temperature. ΔH^0_{298} at 298 K = -54.66 kJ/mol Data: $C_{p,O2}$=6.94 +0.000677 T $C_{p,N2}$=6.5 +0.001413 T $C_{p,CO}$ = 6.35+0.00018 T $C_{p,CO2}$ = 9.1 +0.0048 T [10]	8	CO2	K3
	(OR)			
c.	Calculate the std heat of formation of ethane gas at 25 ^{0}C using the following data. Heat of formation of $CO_{2(g)}$= -393.5 kJ/mol Heat of formation of $H_2O_{(l)}$= -285.8 kJ/mol Heat of combustion of $C_2H_{6(g)}$= -1560.7 kJ/mol	7	CO2	K3
d.	Derive the expression for effect of temperature on standard heat of reaction.	8	CO2	K3
3.a.	A human being (75 kg) consumes about 6000 kJ of food per day. Assume that the food is all glucose and that the overall reaction is $C_6H_{12}O_6 + 6\ O_2 \rightarrow 6CO_2 + 6H_2O$, $-\Delta H_r$ =2816 kJ	8	CO2	K3

Find man' metabolic rate (the rate of living, loving and laughing) in terms of mole of oxygen used per m^3 of person per second.

b.	Write short notes on Arrhenius theory.	7	CO1	K2
	(OR)			
c.	For the following stoichiometry, find the overall order of the reaction $A + B = Products$ Given	8	CO2	K3

C_A	2	2	3
C_B	125	64	64
$-r_A$	50	32	48

d.	Discus about the different types intermediates used in chemical reaction.	7	CO1	K2
4.a.	In a batch reactor, reactant is 70% converted after 8 min and 90% converted after 18%. Find the rate expression to represent this reaction of C_{A0}= 1 mol/litre.	7	CO2	K4
b.	Write the advantages and disadvantages and application of mixed flow reactor.	8	CO1	K3
	(OR)			
c.	A homogeneous liquid phase reaction with stoichiometry and kinetics $A \rightarrow S$, $-rA = kC_A^2$ takes place with 50% conversion in a mixed flow reactor. If this reactor is replaced by another MFR having volume 6 times that original reactor- all remaining unchanged.	7	CO2	K4
d.	Derive the performance equation for design of ideal plug flow reactor.	8	CO1	K3
5.a.	Explain the factors affecting the enzyme activity.	7	CO1	K2
b.	Derive the expression for the rate of product formation for the reversible uncompetitive enzyme inhibition and show the result in Line-Weaver-Burk plot.	8	CO2	K3
	(OR)			
c.	Explain Monod's model for growth kinetics by drawing the graphs.	7	CO2	K2
d.	Derive Michaelis-Menten equation for the enzyme catalyzed reaction.	8	CO2	K3

--- End of Paper ---