QPC: RD20BTECH373 AR 20 Reg. No

GIET UNIVERSITY, GUNUPUR – 765022

B. Tech (Fifth Semester – Regular) Examinations, December – 2022

BPCBT5030 – Bio-Chemical Reaction Engineering

(Biotechnology)

Time: 3 hrs Maximum: 70 Marks

Answer ALL Questions

The figures in the right hand margin indicate marks.

PART – A: (Multiple Choice Questions) (1 x 10 =10 Marks)

Q.1. Answer ***ALL*** questions [CO#] [PO#]

a. Filtration is a ____ operation CO1 PO1
   (i) Solid-liquid (ii) Liquid-liquid
   (iii) Liquid-gas (iv) Gas-gas

b. Absorption is a ____ operation CO1 PO1
   (v) Solid-liquid (vi) Liquid-liquid
   (vii) Liquid-gas (viii) Gas-gas

c. First order reaction rate constant has the unit of CO2 PO1
   (i) time (ii) $time^{-1}$
   (iii) lit/ time. mol (iv) mole.time/lit

d. For first order reaction the PFR is suitable for a particular conversion due to CO3 PO2
   (i) Require less time (ii) Require less volume
   (iii) Both (i)&(ii) (iv) None of these

e. According to Transition state theory, reaction rate constant is proportional with temperature as CO2 PO1
   (i) $e^{(-E/RT)}$ (ii) $T^{0.5}e^{(-E/RT)}$
   (iii) $T\,e^{(-E/RT)}$ (iv) None of these

f. Integral analysis method is used to evaluate CO4 PO1
   (i) Reaction rate (ii) Michaelis Menton constants
   (iii) Frequecncy factor (iv) None of these

g. For small conversion in autocatalytic reaction the best reactor is CO3 PO1
   (i) PFR (ii) CSTR
   (iii) Recycle reactor (iv) None of these

h. If two CSTR connected in series are replaced by a single CSTR of same volume, the conversion of single CSTR will be ___ than previous set up. CO3 PO2
   (i) greater (ii) less
   (iii) can't say

i. Line weiver Burk method is used to evaluate CO4 PO1
   (v) Reaction rate (vi) Michaelis Menton constants
   (vii) Frequecncy factor (viii) None of these

j. Doubling time of cell growth is CO4 PO1
   (i) 0.693/µ (ii) 0.693×µ
   (iii) µ/0.693 (iv) 0.693/µ

PART – B: (Short Answer Questions) (2 x 10 = 20 Marks)

Q.2. Answer ***ALL*** questions [CO#] [PO#]

a. Define excess reactants and limiting reactant. CO1 PO1

b. Define standard heat of reaction. CO1 PO1

c.	What are recycling and bypassing?	CO1	PO1
d.	Define absolute and molal humidity.	CO1	PO1
e.	Define space time and space velocity.	CO2	PO1
f.	Write the significance of recycle ratio in recycle reactor.	CO3	PO1
g.	Write the steps of fermentation process	CO4	PO1
h.	Write the methods of maintaining high concentration of reactant.	CO3	PO1
i.	Define turn over number	CO4	PO1
j.	Mention the factors affecting the enzyme activity.	CO4	PO1

PART – C: (Long Answer Questions) **(10 x 4 = 40 Marks)**

<u>Answer ***ALL*** questions</u>

		Marks	CO #	PO #
3.a.	Calculate the amount of heat required for a gas mixture of 100 Kmol consisting of 30% oxygen and 70% nitrogen (by volume), to raise the temperature from 200 to 300^{0}C. C_p= a + b T , KJ/Kmol ^{0}K	10	CO1	PO3

Component	a	$b \times 10^3$
O_2	26.0	12.0
N_2	24.0	63.0

(OR)

b.	Explain the volume comparison of CSTR and PFR with the help of $1/(-r_A)$ vs X_A plot, for +ve, 0 and –ve order reaction.	10	CO3	PO2
4.a.	$A \overset{K_1}{\rightarrow} R \overset{K_2}{\rightarrow} S$, Derive expressions for C_A, C_R and C_S by considering uni-molecular type first order reaction.	10	CO2	PO2

(OR)

b.	Explain the use of Psychometric chart with neat sketch.	10	CO1	PO2
5.a.	A gaseous feed of pure A (1 mol/liter) enters a plug flow reactor (2 liters) and reacts as follows: 2A→ R, $-r_A = 0.05\ C_A^2$, mol/liter. sec. Find what feed rate (liter/min) will give an outlet concentration C_A = 0.5 mol/liter.	5	CO2	PO3
b.	Derive the performance equation for plug flow reactor	5	CO3	PO2

(OR)

c.	A gaseous feed of pure A (1 mol/liter) enters a mixed flow reactor (2 liters) and reacts as follows: A→ R, $-r_A = 0.05\ C_A$, mol/liter. sec. Find what feed rate (liter/min) will give an outlet concentration C_A = 0.6 mol/liter.	5	CO3	PO3
d.	Derive the performance equation for Mix flow reactor	5	CO3	PO2
6.a.	For enzyme catalyzed reaction, $S + E \overset{K_S}{\Leftrightarrow} ES \overset{K_2}{\rightarrow} E + P$ Derive Michaelis - Menten equation and show the importance of the rate expression when substrate concentration is high.	10	CO4	PO2

(OR)

b.	Derive a rate expression for reversible non-competitive inhibition and show the line weaver Burk plot for this.	10	CO4	PO2

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