Model Question Paper-1 with effect from 2019-20 (CBCS Scheme)

USN

Fifth Semester B.E. Degree Examination

Subject Title Chemical Reaction Engineering

TIME: 03 Hours

Max. Marks: 100

Note: 01. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.

Q.01aWhat is rate of the reaction explain the factors affecting the rate of the reaction.L1,L208bDerive the rate equation for second order reaction and show the nature of the graph.L2,L312ORImage: Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Colspan="2">Image: Colspan="2">Image: Colspan="2">Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Colspan="2">Image: Colspan="2">Image: Colspan="2">Image: Colspan="2">Colspan="2">Image: Colspan="2">Image: Colspan="2"Q.02aExplain the temperature of rate of reaction of reaction and show the nature of the graph.L2,L312Image: Colspan="2">Image: Colspan="2"Image: Colspan="2"Image: Colspan="2"Q.03aDerive the reaction will grow in the presence of a catalyst, if a reaction proceeds at 25° C?Image: Colspan="2"Image: Colspan="2"Q.03aDerive the performance equation for Continuous Stirred Tank reactor indicating proper material balance.Image: Colspan="2"Image: Colspan="2"Q.03aDerive the performance equation for continuous Stirred Tank reactor indicating proper material balance.Image: Colspan="2"Image: Colspan="2"Image: Colspan="2"Q.04aCompare the performance espance time and space velocity in creastry to effect this conversion in a plug flow reactor.Image: Colspa					Mod	lule -1						*Bloom's Taxonomy Level	Marks	
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Q.02aExplain the temperature of rate of reaction dependency from Arrhenius law.L2,L312bThe activation energy of a chemical reaction 17,982 cal/mol in the absence of catalyst, and 11,980 cal/mol with a catalyst. By how many times will the rate of the reaction will grow in the presence of a catalyst, if a reaction proceeds at 25°C?L3,L408Module-2Image: Colspan="4">Image: Colspan="4"Image: Colspan= Colspan="4">Image: C		b	the graph.									L2,L3	12	
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Q. 06aDerive the relation between E and F curve.L2,L308bThe data given below represent a continuous response to a pulse input into a vessel which is to be used as a chemical reactor. Calculate the mean residence time of the fluid in the vessel, tabulate and construct the E curve.L3,L412 $\frac{1}{12}$ \frac		b	Explain the pulse	input	experi	ment fo	or findir	ng E cu	rve.			L2,L3	08	
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			t,min	0	5	10	15	20	25	30	35	1		
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bDerive Michaelis – Menton EquationL2,L312														
	Q. 07						ities wit	h exam	ples.			,		
		b	Derive Michaelis	-Men								L2,L3	12	

Q. 08	a	Explain the following.	L2,L3	10
		1) Enzyme Active site,		
		2) Free and bound enzyme,		
		3) Allostoric enzyme,		
		4) Eadie – Hofstee plot and		
		5) Lineweaver Burk plot		
	b	What is enzyme inhibition .Explain competitive and uncompetitive inhibition	L1,L2	10
		Module-5		
Q. 09	a	Discuss the kinetics of growth associated and non growth associated products formation.	L1,L2	12
	b	Write a note on Leudeking –Piret model.	L1,L2	08
		OR		
Q. 10	a	Explain about the media requirements for fermentation process.	L1,L2	12
	b	Explain the steps of media formulation for optimal growth.	L1,L2	08

*Bloom's Taxonomy Level: Indicate as L1, L2, L3, L4, etc. It is also desirable to indicate the COs and POs to be attained by every bit of questions.

CO-1: Discuss about the different chemical reactions and analysis of experimental reactor data

CO-2: Design of performance equations for the different reactors

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CO-3: Discuss the performance and distinguish between the different types of ideal and non-ideal reactors

CO-4: Determine enzyme activity, to study the fundamentals of Microbial growth kinetics and its stoichiometry

CO-5: Describe medium requirements and media formulation for the optimal bio process

Question		Bloom's Taxonomy Level attached	Course Outcome	Programme Outcome	
Q1	a	L1,L2	CO-1	PO1	
	b	L2,L3	CO-1	PO1	
Q2	a	L2,L3	CO-1	PO1	
	b	L3,L4	CO-1	PO1	
Q3	a	L2,L3	CO-2	PO3	
	b	L2,L3	CO-2	PO3	
Q4	a	L3	CO-2	PO3	
	b	L2,L3	CO-2	PO3	
Q5	a	L1,L2	CO-3	PO3	
	b	L2,L3	CO-3	PO3	
Q6	a	L2,L3	CO-3	PO3	
	b	L3,L4	CO-3	PO3	

1

Q7	a	L1,L2	CO-4	PO7
	b	L2,L3	CO-4	PO7
Q8	a	L2,L3	CO-4	PO7
	b	L1,L2	CO-4	PO7
Q9	a	L1,L2	CO-5	PO7
	b	L1,L2	CO-5	PO7
Q10	a	L1,L2	CO-5	PO7
	b	L1,L2	CO-5	PO7

Model Question Paper-1 with effect from 2019-20 (CBCS Scheme)

USN

Fifth Semester B.E. Degree Examination

CHEMICAL REACTION ENGINEERING

TIME: 03 Hours

Max. Marks: 100

- Note: 01. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.
 - 02. Draw the relevant figures wherever necessary.
 - $\label{eq:constraint} \textbf{03.} \ \textbf{Report the dimensions for the calculated values in the problems given}$

		Module – 1	Marks
	(a)	Illustrate the following terms with the suitable examplesi) Reaction Kinetics (ii) Elementary reaction (iii) Non- Elementary reaction (iv) Rate of Reaction (v) Equilibrium Constant.	10
Q.1	(b)	Prove that the time taken by first order reaction to finish 75% conversion is double the time required to complete its half-life. Also obtain the kinetic rate expressions for the first order reaction in terms of concentration, conversion and half-life.	10
		OR	
	(a)	Illustrate the temperature dependency of rate and rate constant of the reaction using Arrhenius and Collision theory.	10
Q.2	(b)	The reaction started with 0.5 mol/lit has rate constant 1.5min-1.Tabulate the value of unreacted concentration, conversion and reacted concentration at 0.1 min, 0.4 min and 0.8 min. Hence perform the reaction balance. (perform this problem via tabular column)	
		Module – 2	
	(a)	Establish the differences among the various types of Industrial reactors and hence illustrate the their advantages and disadvantages	10
Q.3	(b)	The reaction having the rate equation $-r_{A=}0.01 *_{CA}^{0.5}$ is carried out in CSTR and PFR with $C_{A0}=0.1$ mol/lit. Determine and compare the space time required by the CSTR and PFR possessing flow rate of 1 lit/ min using analytical method.	10
		OR	
	(a)	Obtain the performance equation for Batch, and PFR reactor along with the neat graphs associated	10
Q.4	(b)	A second order is carried out in CSTR to give 90 % conversion. Explore the possible advantage of using the second CSTR in series by assuming that both reactors possess equal Space time. Also in the above mentioned reactor configuration determine the intermediate conversion if the final conversion from the reactor is 90%.	
	1	Module – 3	

Q.5	(a)	With the neat sketch explore the various reasons for Non Ideal flow in a reactor system and hence explain the concept of Exit age distribution.	10

	(b)	With the neat sketch mention the various techniques used to apply the tracer to analyze	10				
		the non-ideal condition of the reactor. Also list out the properties of the tracer.					
		OR					
	(a)	Mention the properties of tracer. Also derive the correlation that exists between C,E,F					
0.6		curves	10				
Q.6	(b)	Determine the values of E-age, and plot the E-Curve for the following data. And hence					
		evaluate the principle of normalization used in Non-ideal flow analysis.					
		t (Sec) Cpulse (g/lit) 0 0					
		5 3					
		10 5	10				
		15 5	10				
		20 4					
		25 2					
		30 1					
		35 0					
		Module – 4					
	(a) Stating the typical enzyme reaction mechanism, obtain the the Michaelis-Menton						
		equation used for enzyme kinetics					
Q.7	(b)	Stating the reaction mechanism derive the kinetic rate expression for the competitive Inhibition.	10				
	•	OR					
	(a)	Determine the various ways of determining the MichaelisMenton parameters along	10				
		with the graphical representation.	10				
Q.8	(b)	Stating the reaction mechanism derive the kinetic rate expression for the Non- competitive Inhibition	10				
		Module – 5					
	(a)	Mention the role of various component in fermentation medium and enumerate its significance	10				
Q.9	Assume that experimental measurement for certain organism have shown that cells can						
		aO ₂ +bNH ₃ \rightarrow c(C _{4.4} H _{7.3} N _{0.86} O _{1.2})+ dH ₂ O +eCO ₂ . Also calculate the yield Coefficients Y _{X/S} and Y _{X/O2} for the same					
		OR					
	(a)	Mention the importance of the media formulation in fermenter for the optimal growth.	10				
Q.10	(b)	Mention the concept of the growth and Non growth associated product formation microbial kinetics.	10				

Ta	ble sł	owing the Bloo	•	Level, Coun	rse Outcome and Programme
Quest	tion	Bloom's Taxo attached	onomy Level	Course Outcom	Programme Outcome
Q.1	(a)		L1	e CO1	PO1
Q.1	(b)		L1 L4	CO1	PO2, PO3
Q.2	(a)		L2	CO1	PO1
~ •=	(b)		L2 L3	CO1	PO2, PO3
Q.3	(a)		L2	CO2	PO1
Z.C	(b)		 L4	CO2	PO2, PO3
Q.4	(a)		L2	CO2	PO2, PO3
	(b)		L4	CO2	PO4
Q.5	(a)		L2	CO3	PO2
C C	(b)		L3 CO3		PO4
Q.6	(a)		L2 CO3		PO2
C	(b)		L4	CO3	PO4
Q.7	(a)		L2 CO4		PO2, PO1
C	(b)		L3	CO4	PO2
Q.8	(a)		L2	CO4	PO2, PO1
-	(b)		L3	CO4	PO2
Q.9	(a)		L1	CO5	PO1
-	(b)		L3	CO5	PO2
Q.10	(a)		L1	CO5	PO1. PO2
-	(b)		L2	CO5	PO1, PO2
			Lowe	er order think	ing skills
Bloom' Taxono		Remembering(knowledge):L ₁	Understanding Comprehensior	n): <i>L</i> ₂	Applying (Application): L ₃
Levels		A 1 ·		er order think	
		Analyzing (Analysis): L ₄	Valuating (Eva	luation): L_5	Creating (Synthesis): L_6

