QP Code: Reg. No | | | | | | | | | | | AY 23

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

B. Tech (Sixth Semester - Regular) Examinations, April 2026

23BCHPC36003 – Chemical Reaction Engineering-II

(Chemical Engineering)

Time: 3 hrs Maximum: 60 Marks

Answer ALL questions

(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.	Differentiate between E-curve and F-curve in RTD analysis.	CO1	K2
b.	Write the properties of a tracer for RTD measurement.	CO1	K1
c.	Compare the advantages of heterogeneous catalysis over homogeneous catalysis.	CO3	K2
d.	Write the rate expression for a porous catalyst based on catalyst surface area.	CO5	K2
e.	Identify the primary reasons behind catalyst deactivation in catalytic reactions.	CO5	K1

PART – B **(10 x 5 = 50 Marks)**

	Answer ***ALL*** the questions	Marks	CO #	Blooms Level
2. a.	Define Dirac-delta function. What is the value of $\int_2^4 \delta(t-3)\,t^3 dt$	2	CO1	K2
b.	Derive the expression for E(t) for N number of tanks connected in series by tanks in series model.	8	CO1	K2
	(OR)			
c.	Prove that Space time is equal to Mean Residence time for constant volumetric flow.	8	CO2	K3
d.	Draw the diagrams of contacting patterns for two phase system	2	CO2	K1
3.a.	The concentration readings given bellow represent a continuous response to a pulse input into a closed vessel	10	CO2	K3

t, min	0	5	10	15	20	25	30	35
C_{pulse}, g/l	0	3	5	5	4	2	1	0

This vessel is to be used as a reactor for decomposition of a liquid A with the stoichiometry $A \rightarrow Products, \quad -r_A = kC_A,\ k = 0.307\ min^{-1}$

(a) Estimate the fraction of reactant unconverted in the real reactor.

(b) Compare this with fraction unconverted in a PFR of the same size.

(OR)

b.	Derive the expression for conversion using the Tanks in series model assuming first order kinetics..	10	CO2	K2
4.a.	Write the steps of mechanism of solid catalysed reaction by showing in a diagram.	5	CO3	K1
b.	Classify the different types of catalysts used in chemical reaction engineering.	5	CO3	K1
	(OR)			
c.	The decomposition of Cumene results Benzene and Propylene in the presence of Pt as catalyst. Write the mechanism steps for a non-diffusion-limited reaction.	10	CO3	K3

Develop the rate law for the above reaction assuming surface reaction rate controlling.

5.a.	Explain the non-isothermal condition developed during the reaction in a porous catalyst. Write the expression for temperature difference in film and within particle.	5	CO4	K2
b.	Derive the performance equation for PFR containing porous catalyst particles.	5	CO5	K3
	(OR)			
c.	Consider a catalytic reaction A → 4R is studied in PFR using various amount of catalyst and 20 lit/ hr of pure A feed at 3.2 atm and 117 ^{0}C. The concentration of A in the effluent stream is recorded for the various work as follows	10	CO5	K3

Run	1	2	3	4
C_{Ain}, mol/lit	0.02	0.04	0.08	0.16
C_{Aout}, mol/lit	0.074	0.060	0.044	0.029

Find the rate equation to represent this reaction using integral method of analysis.

6.a.	What are the steps of succession during reaction in shrinking core model for spherical particles of unchanging size?	2	CO6	K1
b.	Derive the performance equation relating time with radius and conversion, considering diffusion through gas film control in shrinking core model of unchanging size for spherical particle.	8	CO6	K3
	(OR)			
c.	Write the limitations of the Shrinking Core Model.	2	CO6	K2
d.	Derive the performance equation relating time with radius and conversion, considering chemical reaction control in shrinking core model of unchanging size for spherical particle	8	CO6	K3

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