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Question Paper Code: 96901

B.E./B.Tech. DEGREE EXAMINATION, MAY 2022

Sixth Semester

Chemical Engineering

19UCH601 – CHEMICAL REACTION ENGINEERING II

(Regulations 2019)

Duration: Three hours Maximum: 100 Marks

PART A - (10 x 1 = 10 Marks)

1. Pores with diameter less than 2nm (20 A^O) are called CO1- R

   (a) mesopores (b) micropores (c) macropores (d) millipore

2. Adsorption data are frequently reported by CO1- R

   (a) Adsorption isotherms (b) Catalyst deactivation

   (c) Sigmoidal curve (d) none of the above

3. When a catalyst increases the rate of a chemical reaction ,the value of the rate constant CO1- R

   (a) Remains constant (b)increases (c) decreases (d) become infinite

4. For a solid –catalyzed first order reaction A---→P, the pore diffusion offers negligible resistance to reaction to reaction if the thiele modulus of the reaction is CO1- U

   (a) Greater than 5 (b) Greater than 1 (c) Greater than 10 (d) Less than 0.5

5. Find the time required for 98% conversion of a particle for film diffusion controls with molar density 0.0198 g/mol with a radius of 0.5 cm with reacting moles of 0.25 moles of B whose mass transfer coefficient is 10 cm/s with $C_{Ag} = 1.396 * 10^{-5} mol/cm^3$. CO2- App

   (a) 92.663 s (b) 100 s (c) 55.5 s (d) 76.8 s

6. Find the time required for complete burning of graphite particle when chemical reaction controls with the following data ρ_B= 0.183 mol/cm^3 , R=0.5 cm, b=1, k=20 cm/s and C_{Ag} = 8.31*10^-7. CO2- App

   (a) 5505.4 sec (b) 4000.6sec (c) 100.8 sec (d) one of the above

7. SO_2 can be absorbed in absorbers using ----------as solvent. CO1- U

(a) Dimethyl aniline (b) NaOH (c) Na_2CO_3 (d) K_2CO_3

8. CO_2 can be absorbed in absorbers using _____solvent. CO1- U

(a)Ethanol amines (b) NaOH H_2SO_4 (c) Copper Ammonium salts d) H_2SO_4

9. The molecular weight of enzymes will be CO1- U

(a) > than 1000 (b) 2 (c) 10 (d) 20

10. Which of the following reactor arrangements causes fast deactivation? CO1- U

(a) Mixed flow for fluid (b) plug flow for fluid

(c) fluidized bed reactor (d) batch for fluid and solid

PART – B (5x 2= 10 Marks)

11. What are heterogeneous reactions? CO1- U

12. Draw the plot of effectiveness factor versus Thiele modulus and suggest the information inferred. CO1- R

13. What are the three contacting patterns used for gas-solid non catalytic reactions? CO1- U

14. What are multiphase reactors? Give examples. CO1- R

15. What is meant by catalyst regeneration? CO1- U

PART C - (5 x 16 = 80 Marks)

16. (a) Explain in detail about the sol gel method in preparation of catalyst. CO1 -U (16)

Or

(b) Discuss in detail about the molecular (or) non dissociated adsorption. CO1- U (16)

17. (a) Derive the expressions for internal diffusion that takes place in a single cylindrical pore with first order reactions and discuss about Thiele modulus and effectiveness factor CO1 -U (16)

Or

(b) Calculate the amount of catalyst needed in a packed bed reactor to achieve 25 % conversion of 1000 m^3/hr of pure gaseous A (C_{AO} = 1000 mol/m^3) CO2 -App (16)

for:

A-→R $-r_A = 50\ C_A/(1+0.02\ C_A)$

18.	(a)	Find the expression for fraction of B unconverted for mixed flow of a size mixture of particles of unchanging size with uniform gas composition	CO1- U	(16)
		Or		
	(b)	Discuss in detail on shrinking core model and progressive conversion model and derive expression for diffusion through the layers.	CO1- U	(16)
19.	(a)	Discuss in detail the design considerations of various types of gas-liquid reactors.	CO1 -U	(16)
		Or		
	(b)	Explain the mechanism and operation involved in a countercurrent flow (plug flow G +Plug flow L) contacting patterns for G/L contactors.	CO1 -U	(16)
20.	(a)	Derive expressions for concentration-time behavior of the integrated M-M equation in a mixed flow fermentor.	CO1- U	(16)
		Or		
	(b)	Discuss about the inhibition of enzyme reactions by a foreign substance with the kinetic expression for competitive and non competitive inhibition.	CO1- U	(16)

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