F41

B. Tech. EXAMINATION, 2020

(Sixth Semester)

(B Scheme)

(Main & Re-appear)

CHE

CHE302B

Chemical Reactions Engineering–II

Time : 3 *Hours*]   [*Maximum Marks* : 75

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks. Assume missing data if any.

Unit I

1. (a) Write a note on Physical Adsorption and Chemisorption. **5**

   (b) Write briefly on void volume and prove volume distribution methods used for solid catalysts. Also taking into account pore diffusion resistance along with a first order chemical reaction in a single cylindrical pore. Derive the following : $C_A / C_{AS} = \cosh m (L - X)/ \cosh mL$. **10**

2. A packed bed catalytic reactor is to be used to treat 1650 moles of pure reactant per hour at 190ºC and pressure 3.80 bar. Fractional volume change during the reaction is 3.0. The concentration data is available ahead :

C_A mol/lt	:	0.0415	0.0484	0.0567	0.0692	0.0907
R_A mol A/(kg.cat.hr)	:	3.389	4.545	6.451	9.523	12.5

It is desired to have 25% conversion of the reactant. Calculate hours has the quantity of the catalyst required in the packed bed. **15**

Unit II

3. (a) Derive/write a note on Catalyst de activation. **8**

   (b) Explain Waesz Prater criterion in detail. **7**

4. (a) Explain various steps involved in modelling diffusion without reaction. **5**

   (b) Species A, present in dilute concentration is diffusing at steady state from bulk fluid through a stagnant film of B of thickness Δ to external surface of catalyst. Concentration of A at external boundary is C_{AB} and at external catalyst surface is C_{AS}. Neglect curvature. Determine concentration profile and flux of A to surface using shell balance, using General Balance equation. **10**

Unit III

5. (a) Write a note on effective diffusivity and define tortousity. **10**

   (b) Derive differential equation describing diffusion and reaction. Also derive internal effectiveness factor for first order reaction in a spherical catalyst pellet. **5**

6. (a) How do we estimate diffusion and reaction limited regimes ? **8**

   (b) What is Weisz prater criterion for internal diffusion. **7**

Unit IV

7. Write a short note on Slurry reactors and fixed bed reactors. **15**

8. (a) Derive the design equation for fluidised bed reactor. **5**

   (b) Give the fundamentals of non-isothermal reactors. **10**