Code No: NR410802 **NR**

IV B.Tech I Semester Supplementary Examinations, April/May 2005
CHEMICAL REACTION ENGINEERING-II
(Chemical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. The concentration readings in given Table. represent a continuous response to a pulse input into a closed vessel which is to be used as a chemical reactor. Calculate the mean residence time of fluid in the vessel t, and tabulate and plot the exit age distribution E.

2. Tubular reactors for thermal cracking are designed on the assumption of plug flow. On the suspicion that non-ideal flow may be an important factor now being ignored, let us make a rough estimate of its role. For this assume isothermal operations in a 2.5-cm ID tubular reactor, using a Reynolds number of 10 000 for flowing fluid. The cracking reaction is approximately first order. If calculations show that 99% decomposition can be obtained in a plug flow reactor 3m long, how much longer must the real reactor be if non-ideal flow is taken into account?

3. Dispersed non coalescing droplets containing reactant A pass through 3 ideal stirred tanks in series. The mean holding time in each tank is 1.5 hour and the rate constant for the first order decay reaction is $0.1 min^{-1}$. Find the fractional conversion of A in the exit stream from the three reactors.

4. Derive an equation to estimate the conversion for a mixture of particles of different but unchanging sizes under the condition of plug flow of solids and uniform gas composition. Highlight the effect of time for complete conversion of individual particles of different sizes and average conversion of the mixture.

5. Spherical particles of pure carbon are burning. The process is controlled by mass transfer of Oxygen to carbon surface. The mass transfer coefficient obeys an equation of the form
$\frac{k_m d}{D} = A\mathrm{Re}^{0.5} Sc^{0.34}$
What is the ratio of the time required for the radius of the particles to be halved to that required for complete combustion?

6. Derive a rate equation for an instantaneous reaction of any order between A and B, fluid-fluid reaction
$A(gas) + bB(liquid) \rightarrow product$
And sketch the concentration profiles assuming a two-film theory.

7. Write short notes on:
   (a) Experimental methods of finding rates of solid catalyzed reactions
   (b) Experimental determination of pore size and surface area of catalyst.

8. For the solid catalyzed reaction A + B $\rightleftarrows$ R + S, develop an expression for rate equation, if desorption of R is controlling the overall reaction. All components are adsorbed.

⋆ ⋆ ⋆ ⋆ ⋆